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The WORLD'S 2ND LARGEST AMUSEMENT PARK GOES SOLAR

**Six Flags Great Adventure
Unleashes the Power of the Sun**

By Chris Gillespie



Six Flags Great Adventure's award-winning rollercoasters, El Toro (foreground) and Kingda Ka (back). Wikimedia, Paulm27.

Soon Superman won't be the only one getting his power from the sun at Six Flags Great Adventure in Jackson, New Jersey.

In a recent press release, Six Flags Great Adventure announced that the park is set to be powered by a 23.5MW solar development. The project, which is expected to be finished in 2019, will include 40 acres of ground-mounted solar panels as well as solar carports over certain parking lots. Great Adventure is the second largest amusement park in the world and welcomes approximately 3 million guests a year.

"This is a proud day for our company," said Six Flags Great Adventure Park President John Winkler. "This project represents a giant step toward becoming a net-zero facility."

The development will be built by KDC Solar, a New Jersey-based company which has over ten years of experience in building large scale net-metered facilities for commercial, industrial and institutional customers in the mid-Atlantic region.

"We are pleased to move forward with this groundbreaking solar project," said KDC Solar president and CEO Alan Epstein. "Six Flags has been a patient and cooperative partner throughout this process, and we look forward to delivering clean, renewable electricity to Six Flags."

Epstein adds that, once the Six Flags development becomes operational, it will be the largest net-metered solar project in New Jersey. According to both companies, the solar development will also make Six Flags Great Adventure the world's first solar-powered theme park.

Six Flags Great Adventure is no stranger to accolades. Since opening in 1974, Great Adventure has been recognized on a regular basis for its assortment of outstanding rollercoasters. The Kingda Ka steel coaster is

Cont'd on p.35

Will Climate Change Kill Off Fishing in the Northeast?

By George Harvey

Pity the poor brook trout. During the nineteenth century, it was one of the most popular fish with American anglers. In fact, it is the state fish of New York, Vermont, New Hampshire, and six other states. But it has declined rather badly in much of its native habitat. In that respect, it may be taken as emblematic of problems facing many aquatic animals. And the effects of the stresses are matters of vital interest to anglers.

Brook trout are adapted to well-oxygenated, clean, cold water. They become stressed in streams when the water gets sluggish, because it does not have enough oxygen. They do not tolerate pollutants or murky water. And they are not at all happy if the temperature is much over 72° Fahrenheit; at much above that, they die. In addition to these problems, they often have invasive species to contend with.

The effects of these problems have reduced populations of brook trout since the nineteenth century. At that time, fishing expeditions went to sites increasingly

distant from urban areas. The Adirondacks became a popular destination for anglers. But as more time passed, those fishing grounds were no longer productive because of acid rain, and the anglers had to move on to new places.

Climate change is already making streams warmer and reducing water flow in streams of the Northeast. With lower

oxygen levels and higher temperatures, the brook trout have to head upstream, to higher elevations with cooler temperatures. But this drives them into smaller streams, and climate change is bringing more frequent droughts, reducing streams to the point that they cannot support the fish.

Cont'd on p.19



Do climate change, pollution, and invasive species affect fishing?

Fly fishing for trout. Photo by Bryan Ledgard, Wikimedia Commons.

THERE'S CARBON IN THAT SOIL The Solution Beneath Our Feet

By Jessie Haas

Suppose someone told you there was a natural way to pull CO₂ out of the atmosphere and store it underground—a process that could simultaneously protect waterways from pollution, control flooding, mitigate drought, and produce more, and more healthful food. A process that works so quickly it could pull all excess carbon out of the atmosphere within a decade. The person telling you this might seem a trifle over-enthused. You might edge away or change the subject—or blush, because secretly you've been praying for

something like this. Solving this problem by austerity seemed so difficult, so unlike us.

But this is pie in the sky, right? Actually, no. The secret is something so ordinary we've been standing on it all along. Every day for millions of years, plants have been using sunlight to

pull carbon out of the atmosphere, transform it into glucose, and exude 30 to 40% of that carbon-rich material into the soil to feed microbes. The microbes help plants thrive, and in the process create topsoil. And topsoil is one of

the four main carbon sinks in the closed system we call Earth.

Currently we have excess carbon in the atmosphere, which is changing the climate. The oceans absorb

Cont'd on p.20

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

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Green Energy Times would like to thank everyone who has submitted articles or helped in any way to make this all a reality. We want to also thank our advertisers & ask that you support them. Say that you saw them in *Green Energy Times*. Now let's all G.E.T. moving ahead towards a 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

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***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!*





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Letter to the editor:

To the editor:

We very much enjoy reading *Green Energy Times*. We get it at our local Glens Falls, NY YMCA.

We thought you may be interested in knowing about our recent solar installation in support of a business. Two AllEarth Renewables solar trackers were installed at The Hub, a seasonal business in Brant Lake, New York: a bike repair, bistro, pub, coffee shop, and entertainment venue. The trackers began producing electricity February 24, 2018. It is a 13.44MW system and is anticipated to meet most, if not all, of the electrical energy needs of the business.

As you know, AllEarth Renewables is based near Burlington, VT. The installation was done by Apex Solar, Glens Falls, NY. See photos attached. The business owner is Drew Cappabianca of Glens Falls. The financial evaluation, purchase and installation of the project was managed by his mom and dad, Linda & Frank Cappabianca.

Feel free to call or email us if you would like more information. We are quite excited about this!

Thank you, Linda, Frank & Drew Cappabianca

Green Energy Times responds:

We looked into The Hub and want to describe it to our readers.

Imagine living in a cabin on a lake where you bike and canoe on warm summer days. Your bike is out of commission because it needs a minor repair. You have a large canoe, so you and your life partner load the bike into it, and paddle off to the bike repair shop.

At the end of the lake is a small dock, where you tie up your canoe. It is only a few yards to the repair shop where you settle down for coffee while you wait for the work on the bike to be completed.

Just about the time The Hub's main bike repairman, Noah Leggett, stops by to tell you that the bike repair is done, owner Drew Cappabianca comes by and suggests that you take a look at the 207 acre lot behind the shop, where he has put hiking paths. Mountain bike paths, he says, will soon be laid out, as well. Instead of going straight back home, you go exploring.

Maybe you want to stay for lunch. Maybe you want to come back later and have dinner and a beer to cool off. But whatever you decide, in the end of the day, you get your bike and paddle home.

The Hub represents a different approach to life, and one many readers of *Green Energy Times* might think about following. Those who live in the countryside areas might best not copy the life styles of those in towns and cities. "You get rural enough that there is not enough population density to do just one thing. You have to do two or more things to survive," Cappabianca told us.

His approach plays out in The Hub. He explained, "This is basically like a ski lodge or golf clubhouse for cycling." The Hub is designed to be a stopping point for refreshments or a destination on its own, for people who like to be active and out in the open air.

The Hub has about fifteen employees, when it is in full operation during the summer. Nevertheless, its 48 280-watt Trina Solar panels are expected to provide about 24,000 kilowatt-hours of electricity each year, and that is expected to be enough power to provide for all the energy The Hub uses.

The solar system was installed by Apex Solar, whose web site is apexsolarpower.com. If have them install a solar system, please tell them you heard about them from *Green Energy Times*.

The trackers for the system were made by AllEarth Renewables. (allearthrenewables.com)

The Hub is in Brant Lake, New York. Learn more at thehubadk.com or call them at (518) 494-4822.



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SOLARFEST MOVES TO STRATTON MTN

August 18 and 19, 2018

Following discussions first begun in 2015, Board President Bill Laberge announced that SolarFest will be held at Stratton Mountain Resort on Saturday, August 18th and Sunday, August 19th.

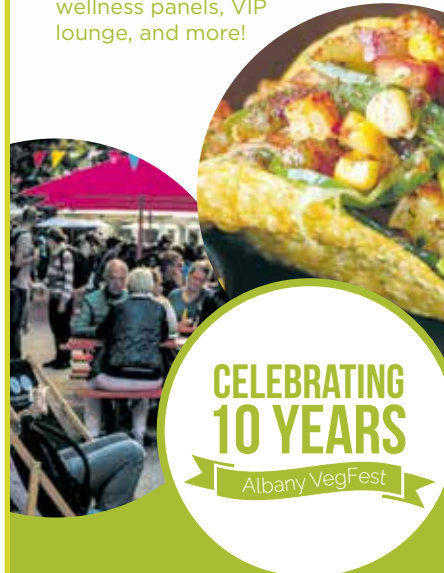
"We need to reduce our greenhouse gas emissions sharply to avoid drastic global warming this century, but unfortunately carbon dioxide emissions from the use of coal, oil and natural gas were back on the increase in 2017," said Bill Laberge, SolarFest Board President. "There are so many advances in conservation and renewable energy that we all need help keeping up, and SolarFest is a fun, relaxing way to learn from knowledgeable practitioners who are eager to help people slash their energy costs and carbon footprint."

Begun in 1995, SolarFest is a celebration of renewable energy and sustainable living. The two day event features live music and arts, nationally recognized speakers, leading experts and practical and wise counsel from local citizens on how we can create conditions that will aid us as individuals and as communities. If you want to learn how to cut electrical, heating & cooling, and transportation costs for home and business, Solar Fest can help. Come learn, experience and have fun this summer at New England's most entertaining source of energy education. It's a program the entire family can enjoy!

More details are available at www.SolarFest.org.

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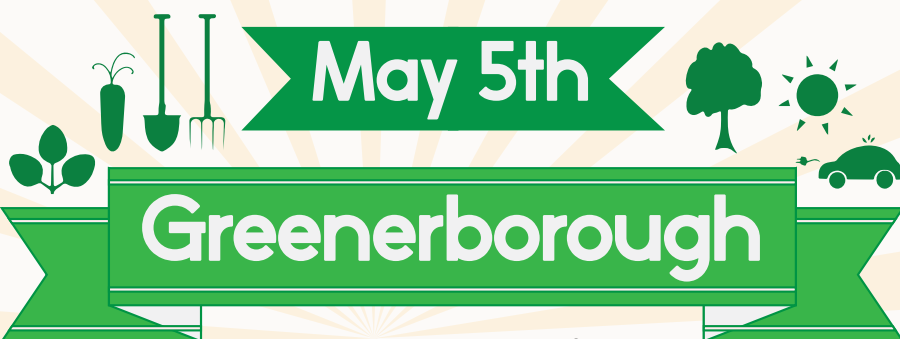
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ELECTRIC MOTORCYCLES HOG THE SPOTLIGHT

By David Roberts

Hooray for spring! For motorcycle enthusiasts it is time to celebrate warmer riding weather and possibly consider a new ride. Fortunately for them, there are great electric-powered motorcycle options available today with more on the way. Electric motorcycles offer many of the same benefits of electric cars – smooth power, low maintenance, easy charging via standard 120V outlets and quiet operation, not to mention no toxic tailpipe emissions and a greatly reduced greenhouse gas footprint.

Zero Motorcycles is an industry leader - they only make electric motorcycles and have been in business for many years. They offer several different models and configurations and have several dealers in the northeast region. The standard Zero S model starts at \$11,000 and has about 90 miles of range. Larger battery options are available with range topping out over 200 miles. They also offer dual-sport and off-road models that can hit your favorite local trails.

Alta Motors is another electric motorcycle manufacturer with several options geared to off-road use. The Redshift MXR retails for about \$12,000 and is designed to compete with a modern 350cc gasoline trail bike and has enough juice to last four hours on single track and woods courses. The throttle response and engine braking can be tuned on-the-fly for beginner or expert driving styles. The direct drive system does away with gears, so riders can focus on enjoying the ride instead of when to engage

Harley-Davidson's Electric Livewire




the clutch.

Not to be outdone by these upstarts, Harley-Davidson toured their Livewire electric motorcycle concept in 2014 to gather feedback from over 12,000 riders on their electric preferences. They recently announced plans to offer a new electric model for sale in the next 18 months. Details are not yet certain, but they are using their Livewire experience to inform the development and collaborating with Alta on technology, so it should be great. No doubt an

**Drive...
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Cont'd on p.5

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THE CARBON FOOTPRINT OF E-BIKES VS. CONVENTIONAL BIKES

DO E-BIKES RECHARGED OFF THE FOSSIL-FUEL GRID ACTUALLY GENERATE FEWER CARBON EMISSIONS THAN CONVENTIONAL HUMAN-POWERED BIKES?

EarthTalk® From the Editors of E - The Environmental Magazine

E-bike pioneer Justin Lemire-Elmore argues that e-bikes are better for the environment, at least if you compare the carbon emissions associated with producing enough extra food to fuel the rider of a standard bicycle against the emissions from coal-derived electricity used to charge an e-bike.

"Although counterintuitive that a vehicle fueled by something as dirty as coal can be considered clean and green, the fact is that food production is much dirtier," reports Lemire-Elmore. "All things being equal, an electric bicycle produces 8.5 times less greenhouse gases than a standard bicycle."

Lemire-Elmore goes on to argue that considerations of the carbon impact of the food we eat should take into account every step "from fork to farm" including greenhouse gas emissions from creating fertilizers, operating farm machinery, delivering raw foodstuffs to factories for processing and then transporting processed goods to a final production and packaging facility before being once again shipped to the grocery store shelf and finally to your pantry via the way-back of your car.

In fact, the average American diet produces 0.005 pounds of carbon dioxide per calorie of food produced, according to researchers from the University of Chicago. Lemire-Elmore uses this formula to assert that a bicycle commute of 15 miles each way would require the rider to consume an extra 800 calories, which in turn, would produce almost four pounds of carbon dioxide per day (or 1,444 pounds per year).



If you factor in the carbon emissions associated with producing and delivering the extra food required to feed a rider of a conventional bicycle, charging up an e-bike from your grid-based electrical outlet may be better for the environment. Credit: Joe Haupt, FlickrCC.

And if you charge up your bike's battery with renewable energy (say, from the solar panels on your roof), fuhgeddaboutit! The e-bike wins every time.

Of course, there's no question that a bicycle, however it's powered, is a far better mode of transport when it comes to environmental impact compared to any of the other choices as well—even walking. According to research by Mirjan Bouwman of the University of Groningen in the Netherlands, travelling one kilometer by bike (electric or conventional) requires approximately five to fifteen watt-hours (w-h) of energy, while travelling the same distance by foot requires some fifteen to twenty w-h. (Meanwhile, covering that kilometer in a train requires 30 to 40 w-h and over 400 w-h in a car

with just the driver.) An e-bike needs only about 10 percent of the energy required to power a car and is 13 times more energy efficient than a typical four-door sedan and six times more efficient than rail transit.

The fact that it might be even better than riding a conventional bike when it comes to your carbon footprint might be just the impetus you need to justify spending the extra dollars for a new-fangled "battery-assist" bike. If everyone knew that you were being even more environmentally friendly by NOT pedaling up that steep hill, who wouldn't go for an



electric bike? And with municipalities pouring millions of dollars into improving infrastructure for bikes and new routing apps making biking safer and more fun, now is a great time to embrace the idea of a two-wheeled commute. Maybe it'll even persuade you to get rid of that car altogether.

Contacts: "The Energy Cost of Electric and Human-Powered Bicycles," www.ebikes.ca/documents/Ebike_Energy.pdf; "An environmental assessment of the bicycle and other transport systems," goo.gl/Lt4Bp6.

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ELECTRIC MOTORCYCLES HOG THE SPOTLIGHT

Cont'd from p.4

electric Harley will be quieter than their gasoline models, so traditionalists will be happy to hear Harley-Davidson has no plans to stop making road hogs.

In addition to these industry leaders, there are several more manufacturers of electric motorcycles – Energica, BMW, KTM, Lightning, and Lito all have options for sale, and other manufacturers are considering entering the market as electric drive technology continues to improve. More than a few homemade electric con-

versions of older gasoline motorcycles are out there too.

For shorter trips around town, there are also great options for electric-assist bicycles and cargo-bikes that cost less, provide an opportunity for exercise when you feel like it, and are great fun to ride.

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

WHO RIDES ELECTRIC MOTORCYCLES?

By N.R. Mallery

Steven Strong, President of Solar Design Associates, and his son ride all-electric motorcycles. Steven is an advocate of all electric vehicles as well as energy efficiency and energy produced from the sun. He told us, "I've been riding for over four decades and have just been waiting for the arrival of the electric MC. I really like my new Zero DS. It is a blast to ride - silent, non-polluting and very fast. My son has the DSR which is scary fast. Both bikes are charged with solar. We both agree there are few things as satisfying as running on sunshine." ♻





Steven and Hunter Strong charge their Zeros at the new Thoreau Memorial Visitor's Center at Walden Pond. Courtesy photo.

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Sources: (1) Vermont Department of Environmental Conservation, 2012 report; (2) Federal Highway Administration, 2008 report

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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 car-pools, 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 elknapp-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

ELECTRIC VEHICLES SHOWN TO BE CHEAPER TO OPERATE AND MAINTAIN THAN FUELED ONES

Many people know that driving an electric vehicle (EV) is good for the planet. But new UCS analysis has determined that American drivers can also save thousands of dollars in fuel and maintenance costs over the life of their cars by switching from a gasoline-powered vehicle to a new EV.

UCS senior engineer David Reichmuth surveyed standard and off-peak electricity rate plans in more than 50 cities across the country to record annual costs for each one. The savings from driving on electricity ranged from \$443 for Houston drivers paying CenterPoint Energy's standard rate to \$1,077 for San Francisco drivers charging their EVs with off-peak power from Clean Power SF.

As the report (online at www.ucsusa.org/EV-savings) explains, these savings are only part of



Image: Wikimedia

the story. Industry experts predict gasoline prices will rise in 2018. In addition, EV motors don't require routine maintenance so are likely to spend less time in the repair shop than comparable gasoline-powered vehicles. According to the American Automobile Association, the average EV driven 150,000 miles will save its owner \$2,100 in maintenance, repairs, and tires compared with a medium-sized gasoline-powered sedan.

“It's an opportune time to buy an electric vehicle,”

says Reichmuth. “For many Americans, EVs are cheaper to fuel and cheaper to maintain—and they are now becoming cheaper to buy as well.”

Reprinted with permission from the Union of Concerned Scientist's newsletter Catalyst, Volume 18, Winter 2018. Learn more at www.ucsusa.org.

NH Electric Co-op Is First in State to Offer Off-Peak EV Charging Rate

To help its members realize the benefits of electric vehicle (EV) ownership, New Hampshire Electric Cooperative (NHEC) has become the first electric utility in the state to offer deeply discounted rates to members who charge their EVs during off-peak hours.

EV ownership is on the rise and most auto manufacturers are currently offering or plan to offer multiple electric vehicle models. EV drivers can benefit from increased efficiency over fossil fuel powered vehicles, as well as lower maintenance costs. NHEC members purchasing or leasing EVs now can also choose an off-peak charging option to further reduce operating costs.

“The auto industry is changing rapidly and we see tremendous potential in the growth of EV ownership,” said Craig Snow, NHEC Vice President of Member Services. “At the same time, it's important to manage this new source of electric load in ways that benefit Co-op members, the regional electric grid and the environment.”

The goal of NHEC's off-peak charging program is to incentivize EV charging during times when regional electric demand is low, thus avoiding the need to build new generation facilities and further strain the New England electricity transmission grid to meet the added demand for power, Snow added.

As part of its new program, NHEC is also offering rebates of up to \$300 to residential members who install Level 2 EV charging stations (240 volts) in its service territory. Rebates will help offset the cost of installing a second electric meter that



Image: NHEC

records EV charging usage and enables members to take advantage of the lower off-peak charging rate. Rebates of up to \$1,000 are also available for NHEC members who purchase or lease qualified EVs. Off-peak rates are effective for EV charging only. Household usage will still be separately metered and billed at NHEC's basic residential rate.

Effective May 1, 2018, the off-peak rate for EV charging will be 8.7 cents per kWh, which is 42% lower than the basic residential rate (effective May 1, 2018) of 14.9 cents per kWh. Off-peak hours are 9 p.m. to 7 a.m. Monday through Friday, and also all hours on weekends and holidays. The rate for on-peak charging will be 22.5 cents per kWh. Rates will be adjusted in May and November each year to reflect the seasonal change in the price of wholesale power.

For participating members who limit their EV charging to off-peak hours, the potential savings is significant. The owner of an EV like the Chevrolet Bolt who drives 16,000 miles a year can save about \$20 a month by charging during off-peak times.

NHEC members who already have a Level 2 EV charger installed in NHEC service territory are also eligible for the rebate if they sign up for off-peak charging and install a dedicated meter.

Visit the EV page on the NHEC website at www.nhec.com/take-charge-save-for-program-details-and-applications, or call NHEC Member Solutions at 1-800-698-2007. Funds are limited and available on a first-come, first-served basis.

CONCORD READY FOR 100 AND NEW HAMPSHIRE CLEAN TRANSPORTATION

By Randy Bryan

The Concord, NH Energy Committee has recently taken up the cause of Sierra Club's Ready for 100 campaign to get the city to commit to 100% renewable energy and transportation by some future date. This is a big step from "advocating for any or more renewables" to "let's make plans for the end game of a fully renewable clean energy future." Wow! We all know it needs to happen, but how do we get from here to there? The Sierra Club now has many cities joining the campaign across the country trying to figure this out. I dare say each city will carve a different path according to its needs and opportunities, but all will head in the same general direction and each path will have to cover all the same issues to complete the transformation.

The Concord Energy Committee is taking the beginning steps of organizing and documenting their ideas into a white paper. I congratulate its chief architects: Rob Werner (committee head), Allyson Samuels (who formerly headed the Hanover, NH program), Zachery Jonas (organizer) and Chuck Willing (white paper editor). From this effort will undoubtedly come subcommittees to tackle individual projects. For me, as a Concord Energy Committee adjunct, just helping them write the transportation part has been thought provoking and empowering.



Supporters of the Concord Ready for 100 proposal rallied in front of the state house in 2017. Image Catherine Corkery, NH Sierra Club.

They are proposing to get all electric power from renewable sources by 2030, and thermal and transportation to go completely clean by 2050. I believe it is feasible, and of course, it is the right thing to do.

For municipal transportation, the suggestions are: to mandate the transportation departments (roads, police, fire, schools, general, etc.) to include electric vehicles in all of each year's vehicle purchase considerations; to judge the vehicles on suitability for the task and lifetime total cost of ownership (not initial purchase price where a tie goes to the cleanest vehicle); to choose the initial electric vehicle purchases or pilot-projects soonest for the core of the fleets, not the periphery; and whenever

possible to engage in public-private partnerships with charge station operators, so that the charging of city-bought plug-in vehicles will also help to stimulate public charging solutions.

In the longer run, with the falling cost of batteries, EVs are projected to have lower initial cost than competing combustion vehicles (within five to ten years) and will still retain their much lower operating costs. With experiences, people will also recognize that electric vehicles are fun and using electric energy for the car will work even better with all their energy needs. Ergo, the obviousness of buying electric will be readily apparent. It's the getting started and having an overarching goal, that is the magic sauce.

I admire Concord's approach and can't help but wonder if the Ready for 100 path might be a good one for more municipalities and, possibly, all of New Hampshire. New Hampshire lacks a long-term strategy to fully clean up its electric, thermal and transportation systems. There have been plans and resolutions to use more renewables, but movement toward planning the end game of going 100% clean/sustainable is not there yet. If it is an idea whose time has come, there are a number of organizations in New Hampshire that might be well suited to take up the cause such as Sierra Club, NH Sustainable Energy Association

(NHSEA), NH Clean Tech Council, Drive Electric NH, and NH Division of Environmental Services. For clean transportation there is much to do on individual, corporate, public and government bases, from considering electric drive for your vehicles, to advancing vehicle charging solutions. If you'd like to see this approach go statewide, get in touch with the Sierra Club or NHSEA. If you do join the cause, I believe you'll enjoy the ride

Randy Bryan has 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. He is one of the co-founders of Drive Electric NH. ♻️

Vermont Clean Cities Coalition News FUNDING OPPORTUNITIES

Burlington Electric EV Financing Program

Burlington Electric Department has partnered with local credit unions to make EVs more affordable for the Burlington Community. The credit unions – Green Mountain Credit Union, Vermont Federal Credit Union, and VSECU – are offering low- and, under certain circumstances, no-interest loans and allowing Burlington Electric customers to apply their \$600, \$1,200, or \$1,800 Burlington Electric EV incentives toward the purchase of EVs. Read more about this new program at bit.ly/BE-EV-incentives.

Go! Vermont Community-Based Grants

Vermont-based communities are eligible to receive \$500 in general operating support for promoting the Go! Vermont program of the Vermont Agency of Transportation. Vermont communities chosen for this round of Smart Commute will promote Go! Vermont as part of the Smart Commute program and thus be automatically eligible for the Go! Vermont small grant. While there is no match requirement, this is federal funding passed through the State and cannot be used as match for federal dollars. For more information on Go! Vermont Community-Based Grants, visit <http://bit.ly/Go-Vermont-grants>.

New Electric Bike Rebate Program for Burlington Electric Customers

Burlington Electric Department is offering its customers \$200 off an electric bike or conversion kit at four Burlington bike retail shops. Bring your ID along with a piece of mail with your name and Burlington address to receive a \$200 point-of-sale rebate on an e-bike or

e-bike conversion kit at a participating retail shop. Find additional information at bit.ly/BE-bike-rebate.

Vermont Electric Utility Electric Vehicle Incentives

Several electric utilities have launched rebate programs that support electric car ownership. Visit Drive Electric Vermont at bit.ly/VE-EV-incentives for an updated list of purchase incentives from Burlington Electric Department, Green Mountain Power, Vermont Electric Co-op, Vermont Public Power Supply Authority, and Washington Electric Co-op.

Title XVII Clean Energy Projects Loan Guarantee Program

The Title XVII innovative clean energy projects loan program (Title XVII) provides loan guarantees to accelerate the deployment of innovative clean energy technology, including electric vehicle (EV) charging facilities. Loan guarantees are made to qualified projects and applicants who apply for funding in response to open technology-specific solicitations. Visit bit.ly/Title-XVII

VEDA Electric Vehicle Charging Station Loan Program

This program is funded through the State Infrastructure Bank (SIB), which is operated by the Vermont Economic Development Authority in conjunction with the Vermont Agency of Transportation and the Federal Highway Administration. Electric vehicle charging stations and natural gas refueling stations available for public use are eligible for SIB financing. For a more information and a loan application, visit bit.ly/VEDA-charging-station-loans.

WIND and SOLAR CAN POWER MOST of the USA



Study shows that wind and solar can indeed power most of the U.S.A.

Solar only works when the sun is shining, and wind only works when the wind is blowing so, as Donald Trump has reasoned in the past,¹ they couldn't possibly handle all of our energy demand, right?

WRONG! In a recently published paper by Dr. Ken Caldeira in the journal, Energy and Environmental Science², 36 years of hourly weather data was analyzed showing that these two energy sources fluctuate in complementary ways.

The study shows a clear path to 100% renewable energy, with just solar and wind! Fortunately, we have other renewable energy sources which can help including advanced wood heating, hydroelectricity, and geothermal energy – not to mention all of the work we have yet to do to use energy more efficiently.

To read a great break down of the study from the Guardian, go to <http://bit.ly/guardian-study>.

¹ <http://bit.ly/d-trump-reasoned>

² <http://bit.ly/jo-nrg-enviro-science>

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Community Solar for Community Action

New Solar Array Planned at SEVCA's Westminster Location

By Becky Himlin

Over 33 million American households struggle with energy poverty, forcing them to make difficult choices between home energy and other basic necessities, such as health care, housing, or adequate nutrition. Currently, the federal Low Income Home Energy Assistance Program (LIHEAP), which in Vermont includes supplemental state funding and is administered by the Department of Children and Families, offers seasonal fuel assistance and temporary emergency relief to low-income residents. However, a stopgap is not a solution, and nationwide energy assistance costs billions of dollars annually. Furthermore, fuel assistance for electricity is currently delivered directly to utilities, leaving low-income households with little choice in where their energy comes from. According to the U.S. Department of Energy (DOE), low- and moderate-income households make up 40% of the nation's population but less than 5% of all solar customers. A lack of resources or viable financing options to make upfront investments in solar and benefit from the renewable energy tax credits available can create barriers to accessing sustainable energy opportunities.

Southeastern Vermont Community Action (SEVCA), a nonprofit anti-poverty organization serving Windham and Windsor Counties in Vermont, plans to build, own, and manage an innovative community solar installation that will use virtual net-metering credits to deliver energy assistance directly to households with high energy burdens. This project, Community Solar for Community Action, will demonstrate a new, nationally relevant, scalable model of energy assistance, enabling low-income households to meet their energy needs while supporting the development of



Rendering of SEVCA's 150kW solar array consisting of ground- and roof-mounted systems. Image: John Ruvelson, RREAL

renewable energy resources.

The project will consist of a 150kW ground- and roof-mounted solar array sited on SEVCA's property in Westminster, VT. Approximately 70 area low-income households with high energy burdens will become subscribers to the solar project, and receive virtual net-metering credits as a form of energy assistance. The system is projected to produce 196,284kWh per year (at a current value of \$33,000) and save approximately 161 tons of greenhouse gas emissions annually.

Community Solar for Community Action aims to showcase a fiscally responsible and environmentally appropriate alternative to conventional, fossil-fuel-based energy assistance. Vermont has a favorable regulatory environment for community solar projects, a population that is highly supportive of renewable energy, and a significant need for energy assistance among low-income households, making this a great testing-ground for this model. The project will help chart a new future towards a more sustainable low-income energy assistance program.

SEVCA has partnered with the Rural Renewable Energy Alliance (RREAL), a Minnesota-based nonprofit, which is helping to develop the project as part of the Solar in Your Community Challenge, a national contest sponsored by the U.S. Department of Energy (DOE). This \$5

million contest aims to stimulate the development of "innovative and replicable community-based solar business models and programs that will bring solar to underserved communities" (<https://www.solarinyourcommunity.org/>). In addition to grants raised by RREAL from the DOE and an anonymous foundation, SEVCA was recently awarded a grant of \$111,000 from the Windham Regional Commission's Renewable Energy Grant Program to help make the project a reality. SEVCA hopes to at least partially integrate the project with the state's Seasonal Fuel Assistance program, such that LIHEAP funding would be directly used to deliver sustainable energy assistance through the community solar project. The project team is currently in the process of identifying and selecting an appropriate contractor to complete the installation of the solar array.

Project goals include:

- **Reducing the energy burden of low-income households** through applying virtual net-metering credits on their electricity bills, based on the energy generated by the solar array.
- **Enabling low-income households to support and benefit from development of renewable sources of energy**, thereby participating in the transition to a more sustainable energy economy.
- **Reducing participating low-income households' dependence on energy assistance** by decreasing and stabilizing their energy costs.
- **Contributing to reducing and stabiliz-**

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ing SEVCA's energy costs for the operation of its main office in Westminster, thereby freeing up scarce resources to use for services.

To learn more about the project, contact Becky Himlin at bhimlin@sevca.org.

Becky Himlin has been SEVCA's Director of Planning and Development since 2014. She has worked for various nonprofit community development, human services, and advocacy organizations for the past 25 years. ☕

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Solar Adds To Sustainability to Newmont Farm ~ Bradford, Vermont

By Evan Lawrence

Newmont Farm, in Fairlee, Vermont, recently completed a photovoltaic system that will supply about half the farm's electricity.

Walter and Margaret Gladstone bought the former Mallary Farm in 1987. Their son Will joined them as owner in 2012. Other family members are also part of the farm's team.

Newmont Farm's mission, according to its website, is "to produce the highest quality milk by providing excellent animal care and being stewards of our land and environment. We strive to be a positive member of our community while fostering a safe team-oriented atmosphere for our employees and create a sustainable business for future generations."

The Gladstones milk about 1,400 cows and have an equal number of young stock. They grow the corn and hay silage for their cows on about 1,700 acres and raise another 200 acres of pumpkins for the wholesale market.

Dairy farms have a heavy electricity demand for milking, feeding, and refrigeration equipment, lights, and machinery. At this time of low milk prices, farmers are looking for savings wherever they can. The Gladstones decided to install a photovoltaic system to help control their utility costs. Margaret Gladstone said they chose solar because an agricultural waste digester was too expensive and wasn't compatible with their bedding material. Wind, she said, "appears to be very controversial."

The array consists of 2,302 ground-mounted solar modules on about four acres in the town of Fairlee, near the town transfer station and handy to three-phase power lines.

Installation was done by Catamount Solar LLC, a member-owned workers' cooperative with headquarters in Randolph, VT. The company designs and installs all types and sizes



A mid-summer evening at the main Newmont Farm location in Bradford, VT. Image courtesy of Newmont Farm. Right: the Catamount Solar crew at work in all kinds of weather. Photos courtesy of Catamount Solar.

of grid-tied and off-grid solar-power systems, from the smallest off-grid cabin systems to large commercial solar fields, and everything in between in Vermont and New Hampshire. The Gladstones said they were pleased with Catamount's work, noting that the workers carried on with digging holes for the racking system even when temperatures went below -20°F.

The 72-cell, 320-watt panels were manufactured by Yingli Solar. The entire system can produce 500kW AC or 736.64kW DC. The inverters are SMA 30kW and 20kW. The racking system comes from RBI Solar. The panels were mounted higher than usual, so that another

farmer can graze sheep under them, reducing the need for mowing.

The array will produce around 885MWh per year, saving the farm around \$149,500 annually, Margaret Gladstone said. That's equivalent to the power demand of 135 homes.

The array is expected to go live in late April or early May.

"The town of Fairlee was great to work with," the Gladstones said. The town has expressed an interest in tying in to the system

for its own renewable energy goals, either at that site or another nearby.

Newmont Farm has adopted other measures to make its operation more sustainable. Cows sometimes die on the farm. Rather than dumping the carcasses in a pit or sending them off the farm for disposal, dead animals are buried in fresh wood chips in a two-bay barn and allowed to decompose. The process goes quickly, and the compost can be safely returned to the fields as fertilizer.

Newmont uses sand as cow bedding, which becomes mixed with the cows' manure. When the barns are cleaned, the manure and sand are taken to another building where the two are separated. The sand is washed with waste water from the milk house. About 80% of the sand is recovered and returned to the barns.

Newmont stores its corn and hay silage in bunker silos, concrete-lined trenches covered with plastic to allow the feed to ferment. Most dairy farms anchor the plastic with used tires. Many of Newmont's tires were recovered

from local roadsides in Green-Up Day collections or came from local garages that went out of business.

For more information about Newmont Farm and its sustainability features, visit the farm website at www.newmontfarm.com.

Evan Lawrence is a free-lance writer in Cambridge, NY, specializing in sustainability, environmental, and health topics.



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ON FIXED VS. ADJUSTABLE MOUNTING SYSTEMS

By Russ Lanoie

"Winchell Factor," as it is often called here in New Hampshire's White Mountains, is a phenomenon that anyone out on a cold, windy day has come to know, often intimately. It is the perceived decrease in air temperature felt by the body on exposed skin due to the flow of air, or the effect on anything that produces heat by cooling it off more quickly as wind

increases. I recently had a chance to see how wind seems to have a chilling effect on photovoltaic (PV) panels that, although they do not produce heat themselves, do warm up when sun hits them.

While working on the roof of our local nature center where a section of glazing on a solar thermal system was broken during an attempt to clear recent stubborn snow and ice, I saw something going on that brought this phenomenon to mind. Although the air temperature at noontime was zero degrees F and the pitch of the roof is moderate to facilitate year round heat production, because the sun was out, the absorber plate of the section where the glazing was missing was heating up nicely and melting any snow we knocked onto it by mistake. This solar thermal system actually forms the roof of this portion of the center so is built into the roof.

While taking a break from the roof, I trekked over to the ground-mounted portion of the Center's PV system to see if I could break off some of its accumulated ice. No chance, as the ice held the PV's firmly in its grip. Even though there was a little section of the panels that was bare at the bottom of the array, the ice and snow above was firmly locked on and not about to yield to my gentle punching with my knuckles. The freestanding PV's were at about the same angle to the sun as the solar thermal system on the main building, about 35 degrees.

Given the chance to reflect on this later, I came to realize that freestanding ground or roof panels mounted away from the roof on rails are much more subject to the outside air temperature, and



Snow is cleared from Lanoie's 40-year-old rooftop solar thermal collectors by accessing them via the two roof windows.

later confirmed my suspicion about built in versus freestanding systems. The PV's built into the roof of the main building were clearing themselves of ice and snow, while the ground mount was still mostly covered with ice, and the PV's on rails on the roof of the nearby intern cabin were completely socked in like my own system on the roof of my barn.

My PV system consists of 40 panels on the roof of my barn at about an optimum year round 38 degree pitch, with wind somewhat blocked by the roof behind it. However, they are mounted several inches away from the roof on rails that are, in turn, mounted onto four-by-four timbers running up and down the roof and screwed through the roof onto the purlins that run horizontally between the beams on this post and beam structure instead of the rails being screwed directly through the roof onto rafters. Because of this spacing, they are subject to chilling winds. And because the roof is way too high for me to reach with a broom that would only clear any loose snow over the ice anyway, I'm pretty much at the mercy of the sun and the air temperature to clear them. This is additionally frustrating when the sun is out as bright as it can be just after the winter solstice, but air temperature remains well below freezing both day and night, keeping ice and snow locked onto the array. I've noticed that most other local roof mounted PV systems also had trouble shedding the latest snow and ice, in great part because a light snow was quickly encased in ice when rain fell the very

next day before the sun had a chance to clear the snow. In fact, it took over a week for my system and several others to finally shed their snow on a sunny day with temperatures that crept up towards 32 degrees F.

All of this brings another factor to light, the subject of tilt angle for PV systems. Built-in roof mounted systems, either PV or solar thermal, benefit from being insulated from wind chill while roof mounted PV systems on rails, though more efficient in cold weather, are more susceptible to nasty freezing rain events. Neither one, however, can be repositioned from summer to winter to take advantage of the sun's declining elevation angle.

Pole ground mounted systems consist of a freestanding pole

with a rack attached only to it and not to any other post or pole. The arrays are generally on a fixed position of about 35 degrees from horizontal at our 44 north latitude in Conway, NH. They can, however, be manually repositioned from summer to winter. This can not only provide benefit by keeping the PV's more perpendicular to the sun's rays to enhance

Cont'd >>



Tin Mountain's main building with built in PV's (left portion of roof) begins to shed snow when the ground mount still has ice locked on in spite of having had some snow raked off.

particularly to a chilling wind, than systems built into a roof. Ironically, freestanding panels generally stay cooler which actually enhances electricity production, as heat decreases PV performance. But it leaves freestanding panels more likely to be affected by snow and, particularly, ice. Recent freezing rain has demonstrated this point.

A follow-up visit to Tin Mountain a day or two

Cont'd >> performance, though admittedly not substantially, but the change from flatter to steeper also helps shed snow. In fact, a steeper angle helps keep snow from collecting on the PV surfaces, because the steep incline helps the snow bounce off and because the horizontal "footprint" of the PV's is less.

I recently talked with an engineer and local weatherman friend, Ed Bergeron, whose freestanding two-pole system I helped install a couple of years ago, a school friend of my daughter's also with a two-pole system, and also Nancy Rae Mallery, the publisher of Green Energy Times, who has a three pole systems in Vermont. They all have been changing the angle of their systems from summer to winter. Nancy sent me photos of her PV's that are clear of ice and snow after our snow and rain event, and Ed tells me that he cleared his quite easily after the same event. I can clearly see the advantage of changing the inclination, both to collect less

snow and ice and to put the PVs at an angle where the sun can do its job of melting, even though affected by chilling winds like we'd recently seen.

Considering all this, if a proposed installation calls for ground mounts rather than roof mounts, it may be more favorable to use multiple pole-mounted racks rather than in-line post type installations, as several owners have taken advantage of the simplicity of changing their pole-mounted system's angle from summer to winter. For built in roof systems, Elon Musk's new PV shingles will likely take advantage of being a part of the roof rather than hanging out where Winchell could keep them encased in ice for frustrating long times.

By the way, I did have to break away some of the ice and snow from the same event discussed here from my 45-degree-mounted solar thermal collectors by reaching the very bottom of them with a roof rake and then following up by accessing them through my two roof windows strategically placed between and beside the three collectors (coinci-

dentally!) A strip of wood poked through the snow and ice got them partially cleared, and the warming sun did the rest. This is one of the few times in the 40 years that these collectors have provided my family with hot water that this has been necessary but may be a hint of what is to come with a warming climate and more freezing rains.

Russ Lanoie is a long time solar proponent in NH's White Mountains. He lives in a passive solar home with solar hot water for 40-years and 11kW of PVs on his barn since 2015. www.RuralHomeTech.com.



Mallery's solar array angle is set for winter to help with snow shedding and to maximize the capture of the sun's rays. The close-up shows the simple adjustment mechanism where loosening a couple bolts will change the array's angle.





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RELiON Lithium Batteries

Replacing a Lead-acid Battery Bank

By George Harvey

In the February 2018 issue of Green Energy Times, there was an article, "Batteries: Lead-Acid vs. Lithium," in which a number of battery types were discussed (bit.ly/GET-offgrid-batteries). Now, we can look at a process of determining what is best to buy for a specific system.

As many readers know, the editor of G.E.T., Nancy Rae Mallery, has lived for years in an off-grid home. In fact, she founded G.E.T. to let people in on the secrets she found that freed her from dependence on fossil fuels and gave her energy independence. Her electricity is dependent on photovoltaic panels, which provide power and charge a bank of batteries. A propane generator is set up to come on as needed, but whole years have passed without a need to use it.

The batteries have turned out to be the most troublesome part of the system.



24-Volt lead-acid batteries. This 48V battery bank has been used for off-grid storage for about six years.

Having gone through 17+ years of off-grid living, she finds it necessary to install a fourth set of batteries. Understandably, she said, "I don't want to have to replace my batteries ever again, and I don't want that generator to come on."

Fortunately, new technology is available. To be sure she was getting the right system, Mallery has been doing much research and checking the math on what to install. She considered a lot of possibilities from a lot of companies.

She wanted a system that needs very little or no maintenance, can be fully recycled at the end of its life, and is very forgiving if something goes wrong. Her perfect system would have to be capable of being discharged fully without harm to the batteries. It would also have to be capable of getting through an accident, such as a puncture or collision, without catching fire, which many lithium-ion batteries would do. She decided that the best technology for her was lithium iron phosphate (LiFePO₄).

LiFePO₄ batteries have another important advantage. Even though they cost more initially than lead-acid batteries, their lifetime costs are lower because they last longer.

A number of companies manufacture LiFePO₄ batteries. Mallery feels that she could recommend RELiON, SimpliPhi, Sonnen, and Iron Edison to readers, based on her research for lithium options. The choice came to questions of what suitable models were available, specifics of the company warranties, and company product and engineering support.

Her current system has 24 2-volt Rolls batteries, delivering 48 volts. Her Xantrex SW4048 inverter and the 2 Outback MX60 charge controllers are in good condition. Since the costs of inverters and charge controllers are high, the strong preference was to install a 48 volt battery bank that would work with the existing compo-

nents and that would store enough energy to last at least 5 to 7 days with no sun. This would mean that she must allow for just under 500Ah of storage capacity, based on current usage. Some options led to a more costly system, partly just due to the number of batteries and more cable connections involved. These facts limited her choices but simplified her search and decision.

Considering the companies involved, she found herself inclined toward the RELiON brand, partly because of the expected longevity and the fact that the engineers seemed very willing to work with her. She asked engineer Craig Quentin, from RELiON Battery Company, what a lifespan of 15 to 25 years meant, in terms of realistic expectations. He said "reliable lifespan estimations are achievable, and 15-25 years is a solid prediction. This is based on the life-cycle testing we have conducted and graphed. At 1 cycle per day and 100% Depth of Discharge (DOD), 5,000 cycles is 15 years. That's worst case scenario. It only gets better from there with lighter DOD's and less frequent discharges."

The remaining questions were what numbers and sizes of batteries in amp-hours (Ah) to use for economic efficiency. Suitable RELiON batteries of 100Ah, 200Ah, and 300Ah are available. She considered the numbers of batteries, numbers of cables, and what size would be most convenient for a minimum system expansion of the system and also for possible increased needs from the addition of



Three RELiON RB48200 Ah batteries, shown in this group, will replace the battery bank shown bottom left.

an electric vehicle in the future.

In the end, the model she chose was the RELiON RB48V200. Three of these batteries will supply her with 28.8 kilowatt-hours of electricity, an upgrade from her old system. And hopefully, it will provide many years of trouble-free service, and the last battery replacement she will ever have to buy.

Learn more about RELiON batteries at reliionbattery.com, or 844.385.9840.

We will look at more battery products in coming issues of *Green Energy Times*. Stay tuned!

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LARGEST COMMUNITY SOLAR PROJECT IN NYS

Sullivan County's 2.7 Megawatt Solar Array Project Supports Governor Cuomo's Mandate of 50% of Electricity to Come from Renewable Energy by 2030

Governor Andrew M. Cuomo has announced the completion of the state's largest community solar project which will result in reduced energy bills for more than 350 households and small businesses. The 2.7-megawatt solar array, located in Sullivan County, is critical to supporting Governor Cuomo's mandate for half of all electricity consumed to come from renewable energy sources by 2030.

"An investment in renewable energy is an investment in the future and sustainability of New York's environment, and the overall health of this state," Governor Cuomo said. "This Sullivan County project will deliver energy savings to residents throughout the Mid-Hudson Valley region, while supporting the establishment of a cleaner, greener New York for all."

The solar array is located in Callicoon, Sullivan County and includes approximately 9,800 solar panels. The project will reduce greenhouse gases by 1,670 metric tons annually, the equivalent to taking approximately 360 cars off the road.

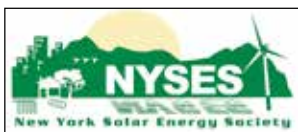
The Sullivan County project is owned by Delaware River Solar. It received nearly \$1.3 million in funding through Governor Cuomo's \$1 billion NY-Sun initiative, which is building a self-sustaining solar industry in New York

State. The New York State Energy Research and Development Authority administers the NY-Sun initiative.

These community-based projects increase access to solar in areas where residents may or may not own property or have room to install solar panels at their location by enabling them to subscribe to a local community solar project. Once households and businesses subscribe, energy is still delivered through their regular electric provider while the power produced from the solar array is fed directly back to the electric grid. As a result, the grid is supplied with clean, renewable energy while subscribers get credit on their electric bills.

In February, Governor Cuomo announced that solar power in New York increased more than 1,000% from December 2011 to 2017, leveraging more than \$2.8 billion in private investments. There are more than 12,000 people engaged in solar jobs across New York.

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Solar PV for Massachusetts Farmers: Promise and Problems

By Roy Morrison



A 16.8kW dual-use array completed in 2009 at UMass Amherst Stockbridge School of Agriculture in South Deerfield, MA. The crops directly underneath the solar panels produced yields comparable to crops in direct sunlight. These crops include tomatoes, beans, and lettuce, among others. Courtesy James Marley, Hyperion Systems, Fall 2017.

The new SMART PV (photovoltaic) solar program in Massachusetts, starting this summer, promises to bring dual-cropping to working farms, allowing farmers to produce both food and energy and sell both to customers.

The agriculture PV rules were developed as a result of test plots at the UMass Stockbridge Institute. Research, led by Professor Stephen Herbert, found that PV mounted on poles, with the lowest panel six feet above the ground and spaced four feet apart, would allow farmers to produce food and energy with only nominal reduction in agricultural productivity and little soil disturbance. The poles are essentially screwed into the ground without typical concrete foundations, according to Jake Marley of Hyperion

Systems who worked on developing the pole mountain systems for Professor Herbert's test plots.

The new dual-cropping methods mean that a megawatt of PV (1000 kilowatts) on poles or raised-table mounts can be installed on about nine acres of pasture or row crops. This is more than twice the area needed for conventional solar farms. This means producing 1.2 million kilowatt hours of energy per megawatt a year, as well as the usual food production from the land.

Dual-cropping is sustainability in action. It's beneficial ecologically, economically, and socially. It makes local food production also mean local energy production. The farm based PV can be organized as Community Solar working with groups like Co-op Power in New England. The farmer gets a new significant income stream that helps keep the farm economically viable. Consumers can now buy reduced cost renewable energy as community solar members.

As in most innovative sustainability efforts, some problems have emerged. The most recent SMART draft guidelines on agricultural PV raise a number of significant potential problems for dual-cropping to reach full potential. First, the new regulations now state that dual-cropping rules do not apply

to MA farms under Agriculture Protection (APR) rules which will still be limited to PV use for farm energy use. The purpose of solar dual-cropping was explicitly designed to maintain agricultural productivity and soil health. But the state wants to withhold dual-cropping from APR farmers who often need its help most.

Under APR, farmers receive payments for selling perpetual development rights to the

state that will keep the land in agricultural production forever. The problem is, that under APR, farms can and often do fail with the farm land being sold to another farmer. I just walked a farmer's land that was a perfect site for 750kW of solar. He

Cont'd on p.14

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NEW HYDROPOWER INVENTIONS

By George Harvey

Two hydropower inventions currently going through the patent process could have far-reaching consequences. Both could enable smaller-scale hydro power projects by making them cost-effective where they had not been previously.

Closed-loop hydroelectric pumped storage

Pumped hydro has been proven a very successful way of storing large amounts of energy. When the spot price of power is low, typically in the middle of the night, electricity is used to pump water from a lower reservoir into a higher reservoir. At high-demand times, typically during the daytime and evening, the water in the high reservoir is allowed to run back into the lower reservoir, generating electricity as it flows, and this is sold at a higher price. Pumped storage enables electricity to be used when it is needed, instead of when it was originally generated. It acts as a big battery. An example of a pumped storage facility can be seen at <http://bit.ly/Northfield-Mountain>.

Pumped hydro has a number of big advantages over other power storage systems. For example, where batteries hold toxic chemicals that could be spilled, pumped hydro has no such environmental risk. Closed-loop pumped storage cycles the water between an upper and lower "bathtub" and almost completely eliminates environmental damage.

One problem with these systems is that turbines can lose efficiency due to cavitations (bubbles) that rob efficiency. These have been eliminated by putting the turbines very low in systems, at the bottoms of deep tunnels conducting water between reservoirs. But the civil works involved, hollowing out mountains to build powerhouses, are very expensive, so usually only large systems will be cost-effective.

Henry Obermeyer, of Obermeyer Hydro in Ft. Collins, Colorado, realized that the high cost of the civil works could be avoided. Placed in a well, the turbine can take advantage of the water pressure to generate hydro-

electric energy. From there, a pipe delivers the water to the lower reservoir. This system avoids the high cost of construction of an underground powerhouse, and allows small pumped-hydro sites to be cost-effective. This means that pumped hydropower can be installed in many places where it had not been practical in the past. Obermeyer's design is cost-effective, for both large and small sites.

Obermeyer Hydro's website is <http://www.obermeyerhydro.com/>.

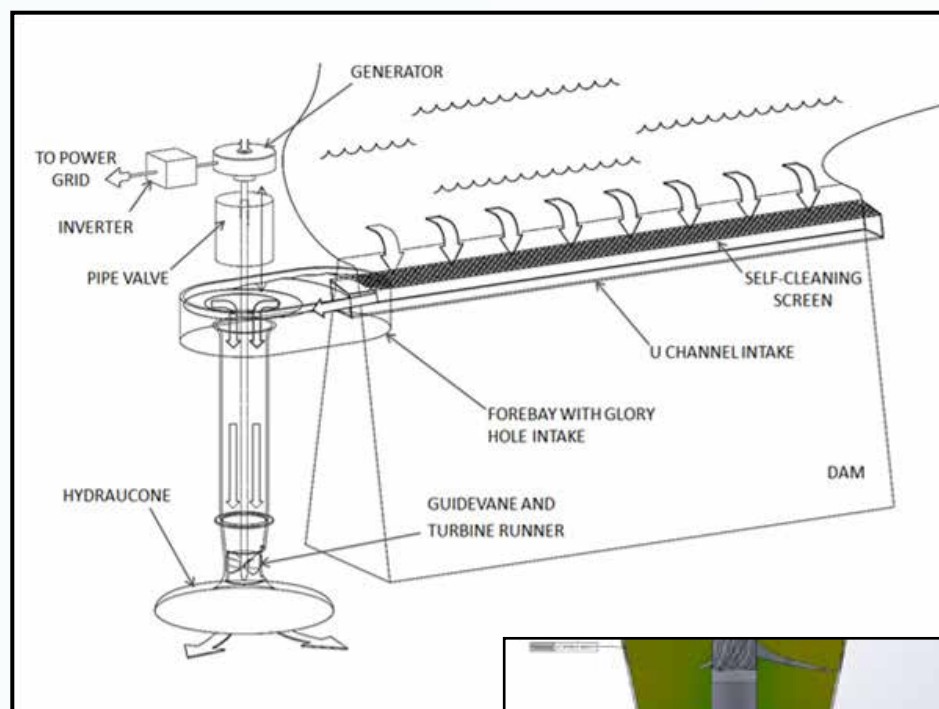
A modular hydroelectric system for existing dams

The Kaplan turbine was invented a bit over a hundred years ago. It was a fairly sophisticated design with variable pitched blades and an adjustable wicket gate to operate effectively as conditions changed. But the turbines are mechanically complex and are more cost-effective at larger sites with output power greater than one megawatt.

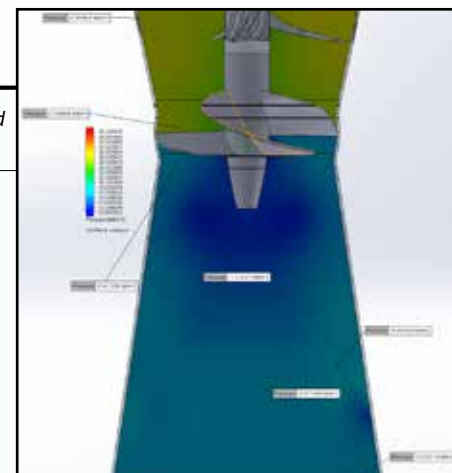
Now, Lori Barg, founder of Community Hydro, in Plainfield, Vermont, has developed a modular system she is marketing under the name "GoHydro." It is a semi-Kaplan turbine system that operates with high performance and efficiency with heads (vertical drops) between seven and fifty feet. This modular system is designed to arrive on the back of a truck and to be installed at an existing dam or drop. There is very little construction associated with the installation, which is designed for easy installation and can produce power within a month. The GoHydro system enables operation of smaller sites at lower cost.

Part of the magic of this newly invented design is that it makes it unnecessary to design and engineer each installation individually. Unlike most fixed speed hydro designs, this variable speed design maintains performance and efficiency at a range of head and flow. Turbines and other parts can be built to standard specifications in a factory, where they can be tested before going out for installation.

In the United States, there are almost eighty thousand existing dams that have no facility to generate power. These dams have been built and maintained for flood control, irriga-



Early drawing of vertical installation of GoHydro low-head hydro system. Courtesy photos.



tion, municipal water supply, lakes and ponds and other reasons. They will not be removed, because they are needed. With the GoHydro system, many of these unpowered dams can produce electric power economically, adding to their value.

Adding modular hydroelectric power to some of these 80,000 existing dams will not have important negative environmental consequences. But the positive results are impressive. One study done for the Vermont Department of Public Service said that in Vermont alone, 90 megawatts of power could be added at existing dams.

Barg believes that the cost of this GoHydro system will be about \$2,500 per kilowatt. This may sound high compared to solar power, which is close to \$1,000 per kilowatt. But, the water flows pretty much full-time, producing about five times the amount of power that

can come from a solar system with the same nameplate capacity.

The pilot site for GoHydro's equipment is being installed in Peterborough, NH. GoHydro is looking for additional sites to install the GoHydro system.

For more information about GoHydro, visit <http://www.communityhydro.biz/>. ☕

Gravity Renewables Expands Operations in Vermont

On February 21, 2018, Gravity Renewables, a leading national owner and operator of small hydroelectric projects, announced that it has acquired three generation projects totaling just less than five megawatts (MW) in Vermont. In addition to two hydroelectric facilities located on the scenic Clyde River in Orleans County, VT, the acquisition includes a 150-kilowatt solar installation.

"Operating and maintaining historical hydroelectric projects so that they can continue to benefit local communities and cleanly power the future is Gravity's expertise," said Ted Rose, Gravity Renewables' CEO. "This acquisition will allow us to do that."

The acquisition includes the 4 MW Newport (VT) Hydroelectric Project with a co-located 150-kilowatt solar installation, as well as the 0.675 MW West Charleston Hydroelectric Project. The hydroelectric facilities have undergone significant upgrades in the past decade to improve operations while enhancing upstream and downstream fish passage on one of Vermont's most treasured recreational rivers.

Gravity operates two additional hydroelectric projects in Vermont located in Springfield and Northfield.


Small hydropower provides predictable, reliable, affordable clean energy that's locally

produced. Gravity Renewables is a national owner, operator and developer of small hydroelectric power plants. By making a long-term commitment to these neighborhood facilities, the company restores and conserves important historical sites, employs local operators and promotes educational and recreational opportunities in the communities it serves. Gravity currently has more than 50 MW of hydroelectric projects operating and under development across the country. Learn more at www.gravity-renewables.com or 303.440.3378.

Solar PV for MA Farmers

Cont'd from p.13

had purchased a failed APR farm and was working very hard on making his farm a going concern. The PV dual-cropping system would mean around \$400,000 over 20 years in lease payments for PV and substantially more, if the farmer became owner of the working PV system which the income stream from the working system would make possible. Unfortunately, blocking APR farms from dual-cropping will perpetuate a cycle that makes farmers and their families seek work away from the farm site and continue



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GoHydro's ultimate goal is to enable previously unaffordable small hydropower sites to produce energy. GoHydro is looking for pilot sites to install at cost. If you have a site with 8-50 feet of head, and design flows of 50-100 cfs, please contact us. GoHydro will provide an efficient, affordable, high performance hydroelectric system at cost for the first six pilot sites. Contact us at lori@communityhydro.biz, 113 Bartlett Road, Plainfield, VT 05667.

to struggle economically.

Second, are proposed new supplemental regulations go beyond rules that the dual-cropping systems approved by an agronomist to maintain farm productivity but require that not a single square foot of farm land reduces sunlight by more than 50%. If this standard were applied uniformly to farms, almost anything built by a farmer such as fence lines, feeding stations, irrigation equipment, animal sheds, and corrals could be prohibited.

It appears that suspicion about dual-cropping, and more than just second thoughts about the wisdom of dual-cropping, has taken root in the MA regulatory mind even before dual-cropping is set to begin in the summer of 2018.

Let's make sure that a new day is really dawning for farmers producing both food and energy.

Roy Morrison is working on dual-cropping www.dual-cropping.com. His latest book is *Sustainability Sutra* (Select Books, NY). ☕

DAIRY AIR WIND FARM - VERMONT'S LAST HOPE, FOR NOW

By George Harvey

Holland, Vermont, a rural community on the Canadian border, is the home of the 450-acre Dairy Air Farm. The farm is run by native Vermonters Brian and Kim Champney. They live on the land they farm, tending a 250-head dairy herd. They, like many other farmers, actively keep alive a vital part of the state's historic culture.

The heavy workload and economic pressures on farmers are legendary. Renewable energy, however, offers a certain improved security to nearly anyone who owns and operates a farm, as an alternative, relatively steady source of income. Importantly, to a farmer, the income is dependable regardless of such weather patterns as droughts or storms that could be destructive to nearly all crops.

The Champneys want to put up a single 2.2-megawatt wind turbine in a corn field on their land, surrounded by the fields and pastures of their farm. The land is flat, and the turbine is not on a ridge line.

Dairy Air Wind, with its single turbine, happens to be the only wind project being developed in Vermont at present. That gives it special significance to people who have no tolerance for wind-related energy. They seem to sense that they can stop any momentum for wind energy in the state, and it may be years before that momentum can be restarted.

Dairy Air Wind is being developed by AllEarth Renewables, whose communications manager Nick Charyk told us, "If we can't support a single turbine on

a family farm, on flat land, when the farmer wants it, we are saying no to everything. There is no more ground to give." He continued, "The stakes are incredibly high."

The stakes are much higher than some people realize. The energy provided under the status quo is making people sick, killing people, and destroying the environment. Figures from the American Lung Association suggest that Vermonters' medical bills from air pollution caused by fossil fuels is about \$1,000 per person per year. The most conservative estimate for deaths we have seen, which came from MIT last year, indicates that nearly 400 people in Vermont die prematurely each year because of air pollution. Numbers from such organizations as the World Wildlife Fund indicate that destruction among wildlife has reduced their populations to perhaps a quarter of what



This photo simulation shows the proposed Dairy Air Wind turbine from the Holland Congregational Church at 693 Gore Road in Holland, VT, 1.8 miles away. Photo credit: VERA Renewables.

they were only forty or fifty years ago.

Clearly, we need to stop destroying ourselves, each other, and the environment. To do that, we need to stop using fossil fuels. To do that, we will need to go beyond merely getting all the electricity we

currently use from renewable resources. We will have to heat our homes, schools, and businesses, operate our vehicles, and drive our economy without burning fossil fuels.

For a safe and comfortable future, we will have to use renewably-sourced electricity for heat, transportation, and industry. This may mean increasing our electric supply by a factor of two or three.

The U.S. Department of Energy tells us that we can get about 55% of our current electric needs met by small-scale distributed power, implying that it could meet perhaps 18% to 30% of future needs. Even adding that to the electricity we already have, we will have to increase our supply greatly. Two likely supply sources are utility-scale solar projects and wind turbines, both of which are being opposed. If these are rejected, we will probably need to import all additional electricity, which will mean building new transmission lines across hundreds of miles of farm fields and ridge lines.

One important point to remember is that despite what many people assume, Vermont is not at all on track to achieve its climate goal of getting 90% of its energy from renewable sources by 2050. Our goals have been effectively slowed to a crawl. We made a good deal of progress in the past, but it will take a long time and a lot of hard work to restore our momentum.

Another thing to remember is that the work that has been stopped would have made living more comfortable, healthier, and less expensive for all of us.

Wind Power on the Farm

By George Harvey



Image: Pixabay.com

or that they had developed a succession plan, and they knew who they were going to pass their farm on to."

Dr. Mills' interests include preserving agricultural land. She is usually worried about houses being built on farming land. In the case of

the farms with wind turbines on the property, however, she said, "In these communities, we are seeing new homes being built, but more often it's grandma and grandpa farmer, who are now receiving wind turbine income, building a ranch next to their farmhouse." She continued, "Because they've got kids or grandkids moving into the farmhouse, and they want to age in place in a one-story building rather than a two-story farmhouse."

Dr. Mills also looked into how much money people were investing into their own farms. What she found was that those people who had wind turbines on their property were investing twice as much as people without.

Skip Pruss, a former Director of the Michigan Department of Energy, Labor, and Economic Growth, spoke to the benefits of wind power for other residents. He said both direct and indirect

benefits are substantial, with benefits, especially monetary support, for local governments and schools. During just two years, Huron County and Gratiot County received about \$45 million in revenues for communities and services.

Liesl Eichler Clark, of the Michigan Energy Innovation Business Council, addressed the intermittent nature of wind resources, pointing out that grid balancers have very sophisticated and accurate tools to know as much as a day in advance how much energy to move into or out of a given area.

Keith Iseler, a local resident and outdoorsman commented that he had seen no unusual

behavior of domestic or wild animals when they were near wind turbines. But he also pointed out that the people he knows are more content to continue to own their land, when earlier they had been inclined to sell it.

Dr. Mills concluded that wind turbines are "really helping to preserve farming communities." They help farmers stay on their farms. They make it easier and more attractive for the subsequent generations to stay on the land. Because they contribute to cash flow and diversify farm income, wind turbines make farming a less risky business.



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Yale Climate Connections, which refers to itself as "a nonpartisan, multimedia service," produced a recent video, "Wind Turbines Supporting Rural Economies, Keeping Young People in Agriculture" (<http://bit.ly/wind-and-agriculture>). It looks at how local people have responded to wind turbines in the two Michigan areas with the greatest numbers of wind turbines, Huron County and Gratiot County.

Much of the video focuses on the work of Sara Mills, Ph.D., of University of Michigan. A fellow of the Gerald R. Ford School of Public Policy, she researched effects of wind turbines on the local farming communities. She summed this up, saying, "What I found was that in communities that had wind farms, those people that were receiving wind farm income were more likely to say that they were going to pass their farm on to a child,

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- 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 and 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. For more information: www.RERC-vt.org or call (877)888-7372.

Advanced Wood Heating

- Advanced wood pellet heating systems -- \$3000 per boiler/furnace
- Custom Rebate \$1.25/ft2 of heated space, \$25,000 max (\$20,000 max for heating system and \$5,000 additional incentive if system includes thermal storage, \$10/kBtu thermal capacity).
- **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/www

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

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

Lighting (must be ENERGY STAR®)

- Special pricing on LEDs at Vermont retailers for as low as \$.95.

Home Efficiency Improvements

- Improvements: air sealing, insulation and heating system upgrades - up to \$2,500 in incentives by using a participating* contractor

Appliances (must be ENERGY STAR)

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

Heating/Cooling

- LP/Oil boilers & furnaces - \$250 rebate*

- Select smart thermostats - up to \$100 rebate
- Solar water heaters - \$950 rebate post installation
- Heat pump water heaters - \$300-\$500 rebate or point of purchase discount
- Central wood pellet boilers (excluding outside wood systems) - \$3,000 rebate
- Circulator pumps - \$15-\$50 point of purchase discount
- Cold climate heat pumps \$600-\$800 point of purchase discount

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 \$600 rebate on select ENERGY STAR models
 - Commercial Refrigeration Evaporator Fan Motors - \$60-\$100 each w/ point of purchase discount
 - Heat Saver Loan -- low-interest loans of up to \$35,000 for home weatherization and heating improvements
 - For commercial refrigeration, lighting, or HVAC rebates, apply online for a 20% bonus at rebates.efficiencyvermont.com
- 1. *all rebates/incentives subject to availability, limits and may change -- for complete incentives and requirements, and for participating retailers/contractors, visit efficiencyvermont.com or call 888-921-5990*

NEW HAMPSHIRE

Renewable Energy Incentives Offered Through the NH Public Utilities Commission

Commercial Solar Rebate Program

Category 1:

≤100 kW AC incentive levels for PV systems:

- \$.70/watt (lower of AC and DC) for new solar electric facilities
- 0.65/watt (lower of AC and DC) for new solar electric facilities
- Expansions to existing solar systems are not eligible.

≤100 kW AC equivalent incentive levels for solar thermal systems:

- \$.12/rated or modeled kBtu/year for new solar thermal facilities fifteen collectors in size or fewer;
- \$.07/rated or modeled kBtu/year for new solar thermal facilities greater than fifteen collectors in size; and
- Expansions to existing solar systems are not eligible.

Category 2:

> 100 kW AC and ≤500 kW AC incentive level for PV systems

- \$.55/Watt AC for new electric facilities.
- Expansions to existing solar systems are not eligible.

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

Note: Category 2 may have a waitlist.

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 Renewable Electric Rebate Program is closed for now.

Check for updates at. <http://bit.ly/NHResidentialRebate>

Contact karen.cramton@puc.nh.gov

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

Contact barbara.bernstein@puc.nh.gov 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 <http://www.nh.gov/oep/programs/energy/pace/index.htm> 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 up to \$2,500
- For Residential Members up to \$300 using Time-of-Use (Off Peak) rates
- Pre-approval is required.
- Visit: <https://www.nhec.com/>

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). For more information please visit www.NHSaves.com/lighting.
- Rebates are available only to residential electric customers of the four NHSaves utilities.s

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
- 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 - \$600 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-base-ment 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 www.masssolarloan.com/loan-support-incentives.

DEPT OF ENERGY RESOURCES

- The Massachusetts DOER is in the process of designing a new solar incentive program. The latest information can be found at <http://bit.ly/SMART-Solar-Incentives-Program>.
- Solar renewable-energy credits (SRECs) associated with system generation belong to the system owner and may be sold via the Department of Energy Resources (DOER) SREC 2 program. Systems sized under 10kW single phase or 25kW three phase have an extension until the new incentive program starts in 2017. Note: appropriate, approved Data Acquisition System monitoring must be utilized for PV systems >10kW in order to qualify to sell SRECs.
- Next solar incentive information can be found at <http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/rps-aps/development-of-the-next-solar-incentive.html>
- 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 SREC II Policy

Massachusetts' Solar Renewable Energy Credits Program, SREC II prioritizes sites, by using an SREC factor based on the type of installation.

- The credits provided for energy produced by a system are calculated b multiplying the factor times a full credit value.
- Full credit is given for residential, parking canopy, emergency power, or community-based systems, or any other system of less than 25 kW.
- Larger systems get a factor of 0.9, if they are building-mounted or at least 67% of the power produced is used at the site. If a larger system meets neither of these criteria, but is built on a landfill or brown-field site, or if it is less than 650 kW, then it gets a factor of 0.8. Systems that qualify for none of the foregoing get a factor of 0.7.
- Expect changes in spring 2018.
- http://bit.ly/Mass_SREC_II.
- MA State Incentives can be found at: www.masscec.com/get-clean-energy

Woodstove Change-out Program

- 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.
- Standard rebates range from \$1,000 to \$1,500 per change-out, and low-income rebates range from \$2,500 to \$3,000, based on stove specifications
- <http://www.masscec.com/commonwealth-woodstove-change-out>

Electric Vehicles

- MOR-EV provides rebates of up to \$2,500 for the purchase or lease of zero-emission and plug-in hybrid light-duty vehicles. Visit: <https://mor-ev.org/>

**UP-TO-DATE INCENTIVE INFO
CAN BE FOUND AT:
WWW.DSIREUSA.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.nyserdera.ny.gov/All-Programs>

Programs

New York State Energy Research and Development Authority.

- Business & Industry
- Communities & Governments
- Partners & Investors
- Cleantech & Innovation
- Residents& Homeowners

Home Energy Waste

Getting a home energy assessment can help you take control of your energy costs. It can 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 INCENTIVES OFFERED THROUGH 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 information on the status of block and current incentive levels by sector and region. Block status is updated as applications are submitted, so click the refresh button to see the current status.

- <https://www.powerclerk.com/nysuninitiative/dashboard.aspx>

Residential and Small Business

<http://ny-sun.ny.gov/Get-Solar/Residents-And-Small-Business>

Commercial and Industrial

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

Community Solar

- <http://ny-sun.ny.gov/Get-Solar/Community-Solar>

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://ny-sun.ny.gov/Get-Solar/NY-Sun-Financing>

Clean Power Estimator

- <http://ny-sun.ny.gov/Get-Solar/Clean-Power-Estimator>

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://www.nyserdera.ny.gov/All-Programs/Programs/Drive-Clean-Rebate/How-it-Works>.

Utility sponsored incentives & tips:

http://bit.ly/utility_sponsored_incentives

ECOLOGICAL ECONOMIC GROWTH

An Imperative Policy Path

By Roy Morrison

This is not the only possible path toward the pursuit of ecological ends, but I believe it is one most consonant with global realities, possibilities and prospects.



Antarctic sunset NOAA photo

The fact that it was warmer at the north pole than in parts of the U.S. and Europe in February 2018 should get more than our passing attention. It is time to pursue a global agenda for dramatic and healing change on an emergency basis. It is a time to seriously examine and then pursue an agenda for global ecological economic growth, to take the necessary steps to enlist market forces, the price system, law, and regulation to make economic growth mean ecological improvement. Is this wild-eyed ecological heresy? Or is it a road that can allow a global market system to pursue profit, the regeneration of ecosystems, social and ecological justice?

All of us concerned about the emergent global ecological catastrophe need to examine and, in my view, embrace an ecological global economic growth agenda as our individual and collective guide for building a sustainable and just ecological social system, an ecological civilization.

Right now, we are afflicted and assaulted by the murderous inanities of an administration of polluters attempting to eviscerate the biosphere in the name of free markets, and it is precisely the moment to pose and to practice a countervailing and healing doctrine of the necessity of building a global ecological economic growth system. Deliverance cannot be a return to the pre-catastrophe certainties of neoliberal internationalism and the Washington consensus embracing pollution and inequality more or less as usual with limitations on the margin of pollution, depletion, and ecological damage. Nor can we be satisfied by amorphous voluntary plans to limit global climate increase to two degrees centigrade.

We must embrace ways to systematically slash global greenhouse gas emissions to a sustainable 21 gigatons per year, or three tons per person carbon dioxide equivalent combined with annual sequestration of gigatons of carbon in soil and biomass reducing atmospheric carbon to sustainable pre-industrial levels. This means global adoption of a renewable-resource economy to completely displace fossil fuel plus transformation of agriculture, forestry and aquaculture. It means many trillions of dollars in sustainable investment. It means the pursuit not only of dramatic reduction in global pollution, but of global poverty and inequality. An ecological world cannot be sustained on the basis of a consuming and polluting rich minority and an obedi-

ent and endlessly suffering poor. We all must and will sink or float together.

I believe this is the only realistic and practical path to both ecological and social deliverance. The other alternative is de-growth, to pull the plug on economic activity and economic growth, the global depression, deindustrialization path. This is politically and practically impossible. It is a call that will be rejected by the rich, the middle class and certainly the poor. Still increasing global population calls for an increase in output or a radical redistribution of resources. It is only the path of economic growth leading to ecological improvement that poses a realistic possibility for global convergence upon sustainable norms.

A time of unvarnished and self-conscious attack upon the biosphere by Trump, Pruitt and Zinke helps us

pose questions beyond longing for the not so bad old days. First, what does an ecological global economic growth system really mean? Second, why is an ecological economic growth system not only possible, but essential? Third, what are the ways and means of getting from here to there—from an afflicted present to a sustainable, prosperous and peaceful ecological future that will come to be known as an ecological civilization, an enduring human way in the cause of all life on this planet?

The argument that ecological global growth is possible does not imply it is either easy or simply a matter of changes on the margin to industrial business and pollution as usual. Ecological global growth means a fundamental reformation of industrialism. This will mean not green washing, not just slogans, but a dynamic planned, clearly articulated and continuously evolving practices of ecological economic growth, of human activity writ large in service to ecological practices and ecological ends.

The planned specificity I have in mind will arise from a coordinated application of new market rules, prices shaped by ecological assessments and taxes, new law redefining fiduciary responsibility as conduct leading not just to profit, but to ecological improvement, as well as social and ecological justice, not just locally, but ultimately globally. This is not the only possible path toward the pursuit of ecological ends, but I believe it is one most consonant with global realities, possibilities and prospects.

We simply cannot wave a magic wand and assume corporate capitalism does not exist, nor can we suddenly practice a de-growth ethic, celebrating quarterly reports of deepening depression and economic contraction as signs of our coming deliverance from ecological peril.

In contrast, an ecological global growth system understands that there is no necessary connection between increasing mathematical amounts of money and ecologically destructive activities under the rules, laws and practices mandated for the conduct of an ecological global

growth market system that we will explore. This is a system that will not be handed to us from on high, from Washington or from Paris climate accords. It is global political and social power, people power, wielded for ecological ends that will mean the active pursuit of ecological global growth whereby economic growth means ecological improvement, the repair and restoration of eco-systems and the living world, of so-called natural capital. Such a transformation is a global task and cannot be separated from the pursuit of both ecological and social justice for all.

The planet cannot survive ecologically with a rich high polluting minority and a poor struggling majority any more than, as Lincoln noted, our union cannot exist half slave and half free, it must be one or the other. And power, as Fredrick Douglass understood, will concede nothing without a struggle, in this case a global non-violent struggle for ecological survival for radical reform that is indivisible, at bottom, from the pursuit of ecological and social justice for all.

It is my firm belief if we do not achieve a global market economy that is based on the pursuit and successful conduct of ecological economic growth as an achievable imperative, then it is highly likely that ecological catastrophe will be unleashed on a planetary and geological scale that will impact the planet and the biosphere for many, many thousands of years. This will mean the end of capitalist markets

both socially and globally through social, political and ecological collapse. This will be the reality of de-growth as imposed catastrophic stringency. Our only real choice is that we must pursue an ecological growth way as if our lives and our grandchildren's lives depend on it, because they do. If we do not pursue an ecological path, we court the advent of climate change that can lead to a period familiar to the Eocene thermal maximum lasting for more than two thousand centuries.

An ecological growth system is a way to slash pollution, depletion and ecological damage, to end

global poverty, and embrace a fair and prosperous global deal for all within an ecological global market system that pursues, as economic and political imperative, zero pollution, zero waste, justice and fairness. The birth and development of such a global ecological civilization will mean a global end to poverty and a global convergence upon sustainable norms for all such as a personal sustainable global standard of three tons of carbon per person per year, around 21 gigatons, combined with soil building and biomass to remove several gigatons of carbon from the atmosphere yearly to reduce atmospheric carbon to pre-industrial levels. Such a three tons per person per year goal is the basis for concrete planning and serious action on all scales from your house to nations. The U.S. is currently at around 16.5 tons, Bangladesh is 0.5, South Korea is 11.6 tons, North Korea 1.6 tons.

Achieving ecological global growth is an explicitly high economic growth strategy. It means, for example, a rapid and complete global transformation to an efficient renewable energy system and an end to

burning fossil fuels. The technical, economic, political tools are available to plan, catalyze and direct this transformation. We are rapidly running out of time to stop behaving as if we have unlimited license to exceed the carrying capacity of biological systems, which we and all other organisms share and depend upon. To say that our economic system must continue to act as a blind and self-destructive monster is an insult to the power of human imagination, effort and ingenuity that can separate economic growth from ecological damage, for example, the practically limitless ability to trade information of all sorts in a renewably powered cyberspace.

Ecological economic growth represents the active pursuit of sustainability and social and ecological justice. Ecological economic growth is the rejection of neoliberalism and reactionary nativism by employing ecological market means and democratic social choices.

The decision we face is not between embracing planning, or embracing markets. Rather, it is the nature and consequences of both planning and markets that must be carefully shaped and conditioned to achieve ecological ends. It is the market and planning rules, law, and regulations, and the government and democratic structures that support them. This means unequivocally that ecological assessments must make sustainable goods and services less expensive, gain market share, and become more profitable, while unsustainable goods and services become more expensive, lose market share and become less profitable. Choices and rules that inform and shape prices is a fundamental basis for an ecological economic growth system. The price system, if and only if we get the prices right, can be a tool for ecological survival.

The wild ferocious power of market forces must be domesticated and used for sustainable ends. This means the adoption of new ecological market rules and the policies and plans that guides and supports them. At bottom it is the human and ecological consequences of economic activity that matters, not the abdication of social and ecological responsibility to a blind pursuit of profit. We can and must assure that economic growth means not just increase of wealth, but means the regeneration of the ecosphere and the improvement of social and ecological justice.

It is well within the power of democracy, of law, new market rules, investment, fiscal and tax policy, and the power of our imagining and intellectual creativity to craft a new ecological world order for economy and markets. This must be built by a combination of bottom up and top down efforts, house by house, block by block, city by city, state by state, nation by nation, and continent by continent. The ecological transformation must be a road that we build as we travel.

Roy Morrison's latest book is *SustainabilitySutra* (Select Books, NY 2017). He is currently working on installing solar on working farms www.dual-cropping.com.

References will be available with the posting of this article on the Green Energy Times website at <http://bit.ly/GET-green-growth>.

“At bottom it is the human and ecological consequences of economic activity that matters, not the abdication of social and ecological responsibility to a blind pursuit of profit.”

“Our only real choice is that we must pursue an ecological growth way as if our lives and our grandchildren's lives depend on it, because they do.”

BURLINGTON 2030 DISTRICT CHALLENGE

By Barbara Whitchurch

BURLINGTON 2030 DISTRICT®

What is the 2030 Challenge (also known as the 2030 District Movement)? Well, the premise is actually quite simple. Buildings account for over 40% of the CO₂ emissions and over 45% of the greenhouse gases (GHGs) created in the U.S. each year. (Urban environments emit 75% of GHGs globally.) Therefore, improving the efficiency of buildings will greatly help to mitigate the causes of climate change.

Specifically, the 2030 Challenge has divided the built environment into two major categories: (1) new buildings/major renovations, and (2) improvements to existing buildings. Both categories aim to reduce energy use and CO₂ emissions incrementally, resulting in a 50% reduction in existing buildings, and carbon neutrality (over 90% reduction) in new buildings.

What are the "Districts?"

There are 17 established Districts nationwide, with more emerging. They have pledged to meet the 2030 Challenge by reducing building energy consumption, water use and transportation emissions by 50% by 2030.

The city of Burlington is the third smallest of the established Districts, established in 2017, but it is practically unique because it includes the entire city, whereas most of the other Districts are areas within a city. (Stamford, CT is the only other city-wide District, and Burlington was first.)

Each District is a unique private/public partnership, including property owners/managers, local government entities, and business/community stakeholders, working together to create urban sustainability. Participation is completely voluntary. The Vermont Green Building Network (VGBN) became the District's non-profit sponsor, and Burlington Electric Department (BED) and Vermont Gas signed on early. CX Associates, an engineering consulting firm, and VGBN were hired as the District's management team. Property owners are included on the Steering Committee to facilitate shared goals and "buy in." (For more information on forming a 2030 District, visit <http://bit.do/2030-tools>.)

How it Works

Like most established cities, Burlington has many inefficient buildings that need to be upgraded. Vermont's cold climate accentuates that need. The District helps property owners increase their property value while reducing their operating costs. The approach is very practical and direct. Eric Morrow, an architect and the Chair of the Steering Committee, said, "We are trying to get them all to speak the same language."

A team assists property owners and service providers in developing a Property Energy Plan (PEP) by analyzing the energy needs of the building and the opportunities for improvement. Owners are asked

to commit to energy use reductions by setting incremental targets. Techniques include air sealing, replacing mechanicals, roof and window upgrades, etc. The process starts with a "walk-through" involving BED or Vermont

Gas and an interview with the property owner or manager. A baseline for energy usage and a target goal are established. Then a PEP is developed with the property owner/manager and the District Team. The team also has committees which are developing strategies to achieve energy, water (also known as "watergy") and transportation goals. Medical institutions, educational institutions, the City of Burlington, service providers and utilities have also chosen to participate.

Where is the Burlington 2030 District today?

So far, 388 million square feet of property have been committed nationally. Thus far, 6 million square feet out of 40 million potential square feet of Burlington's conditioned space have already been committed to this project. The University of Vermont and Fletcher Allen Health Care, both huge users of energy, have joined the Challenge. City Market is a new private partner!

On Tuesday, May 1, there will be a 2030 District Launch Event and celebration from 5:00 to 7:00 pm at Union Station in Burling-

Districts participating in the 2030 Challenge



Mayor Miro Weinberger Supports Net-Zero Energy City

Burlington Mayor Miro Weinberger, in his State of the City address on Monday, April 9, 2018, cited making Burlington a Net-Zero Energy City by 2030 as his top priority. He added that all of the city's energy is already 100% renewable, but "more needs to be done in the areas of heating and transportation to reach the goal by 2030."

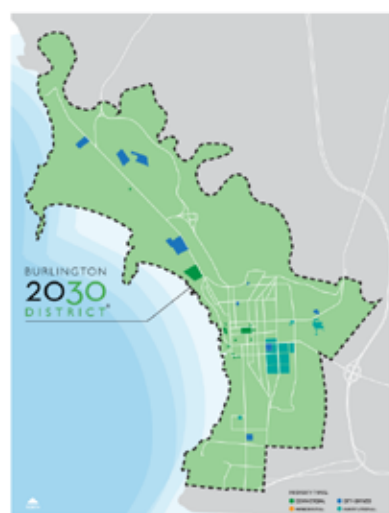
ton. More details will be available on at <http://bit.do/BTV-2030> and on Twitter: @BTV2030.

Barbara Whitchurch owns a net-zero-energy passive house and is a board member of Vermont Passive House.

Many thanks to our sponsor:



Map of the Burlington 2030 District



District Membership
Total Burlington 2030 District Square Feet (SF) Committed to Date:

6,018,816 square feet

% of Burlington SF Committed:
Approx. 15% (of finished SF)

[Total square footage in Burlington: 38.8 M SF of finished area]

SF by Property Type



Image: Eric Morrow

Fishing in the Northeast

Cont'd from p.1

Some of the problems with invasive species are not intuitively obvious. For example invasive insects, such as woolly adelgids, have shown themselves capable of killing large stands of forests. This causes loss of shading over streams and allows soil to wash into them. So invasive insects can kill whole fish populations they have nothing to do with directly.

Of course, it is not just brook trout that are vulnerable. Many species are in trouble, and, without doubt, some will become extinct. Brook trout are likely to be kept alive in carefully selected refugia in northern areas. Other aquatic life will not be so lucky. In most cases, we humans do not seem to care much. After all, whoever has even heard of the dwarf wedgemussel? It is

one of many species with no advocate to call attention to its plight.

Invasive species can become important to the changing ecological systems, of course. Brook trout are being replaced by brown trout. Native crayfish are being replaced by rusty crayfish. Some invasive species are edible, and of their own interest. Quagga and zebra mussels are serious problems, for example, but they provide food for perch and sunfish. In some places, numbers of perch have increased five-fold. Unfortunately, they have issues many people are not yet aware of, such as potential for increasing accumulations of toxins and other contaminants in the food chain.

Those who enjoy eating fish they have caught should definitely look at government sites letting them know what waterways and what fish are safe. Mercury

in the fish is an especially important issue, because burning coal causes mercury to be vaporized and to come down in rainfall, often hundreds of miles from the plant where the coal was burned. Nature has no ready way to remove it, so the concentration just builds up. In the Northeast, we get mercury from all the coal-burning industries and power plants of the Midwest, so every state in the area has information on fish or other wildlife that are safe to eat, often by species and source. Some of these can be found as follows:

- Maine: <http://bit.ly/ME-fishing-safety>
- Massachusetts: <http://bit.ly/MA-fishing-safety>
- New Hampshire: <http://bit.ly/NH-fishing-safety>
- New York: <http://bit.ly/NY-fishing-safety>

- Vermont: <http://bit.ly/VT-fishing-safety>

There is good news. Things we do to address pollution can sometimes be remarkably successful. Many of us remember a time when Lake Erie was considered dead, for example, and some estimates were that it would take two thousand years for it to recover. But that story developed differently than expected.

After the Clean Water Act became law in 1972, the lake bounced back far faster than expected. In 2016, Bassmaster listed Lake Erie as the fourth best bass fishing lake in the country (<http://bit.ly/Lake-Erie-bass>). Perhaps other problems have more hope than we would imagine, if we just do our work on them. ♻

Sustainable Farming Meets the Future

THERE'S CARBON IN THAT SOIL The Solution Beneath Our Feet

Cont'd from p.1

carbon, but show signs of reaching capacity. Trees, the third carbon sink, are vulnerable to manmade destruction or burning, which releases their carbon to the atmosphere.

Soil is the fourth major carbon sink. Left undisturbed, carbon in the soil is stable and long-lasting, and creates fertility. But in the last 10,000 years, agricultural soils have lost 50 to 70% of their carbon. Plowing is the chief culprit. Unzipping the sod allows carbon to escape back into the atmosphere, overheating the planet and exhausting cropland. We humans have left a long trail of degraded soils behind us. Fertile Crescent, anyone?

The good news? It's possible to put atmospheric carbon back in the ground where it came from. No new technology is needed—just plants and grazing animals, properly managed. Scientific estimates vary as to how much is possible, but the numbers are staggering. According to recent research, a 2% increase in organic content in the planet's soils, especially in its grasslands, could absorb all excess atmospheric carbon within a decade. Many American farmers are reporting doing even better than that. Using no-till planting, cover crops, crop rotation, and intensively managed grazing, Gabe Brown in North Dakota has increased soil carbon on his land from 2% to 6% in twenty years.

It's possible to put atmospheric carbon back in the ground where it came from.

The benefits are large. Farms' profits increase as chemical inputs decline (chemical fertilizer and pesticides kill soil microorganisms, so farmers transition away from them). As a result, the soil can absorb more rainfall, mitigating floods and waterway pollution. They retain moisture better during droughts. Biodiversity is increased, and crops contain more micronutrients.

The beauty of this is, well, beauty: green fields, cows on pasture, clean lakes and rivers, less flooding, fewer droughts, and great food you can enjoy with a clear conscience.

Everyone who eats or has control of a piece of land no matter how small can contribute. Buy grass-fed dairy and meat. Mow lawns high and infrequently (or use electric mowers). Keep the soil covered with mulch and cover crops. Make compost and spread it on the land. Support legislation to fund the transition for farmers.

Nature knows how to do this. She's done it before. Cooperating with plants, animals, and microbes, we can put excess atmospheric carbon back into the soil, creating beauty and abundance as we cool our flustered planet.

Learn more from these books and videos:

- *Cows Save the Planet and Water in Plain Sight* by Judith D. Schwartz
- *The Carbon Farming Solution* by Eric Toensmeier
- *Drawdown* by Paul Hawken
- *Growing a Revolution* by David Montgomery
- *Grass, Soil, Hope* by Courtney White.

Some helpful links are: thecarbonunderground.org; rodaleinstitute.org; nofamass.org/carbon; and soil4climate.org.

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. ♻️



Mettowee Valley Farm, Vermont. Painting by Vermont Artist Peter Huntoon.

"I don't know how many times I've driven by this beautiful farm on Rt 30 just north of Dorset and said I've GOT to paint that someday. Well, someday finally came." - Peter Huntoon.

See more of his work at: www.peterhuntoon.com.

THE FARM AT EASTMAN'S CORNER

A SHINING EXAMPLE OF THINKING GLOBALLY & ACTING LOCALLY:
HOW ONE NEW HAMPSHIRE FARM IS USING GOOD FOOD AND GOOD PRACTICES TO DO GOOD FOR THE COMMUNITY

By Chris Gillespie



An aerial view of The Farm at Eastman's Corner and all of its solar arrays. Image © Farm at Eastman's Corner.

If you're looking for a fun springtime outing that also happens to be educational and environmentally-friendly, look no further than The Farm at Eastman's Corner in Kensington, New Hampshire.

Since its opening in 2013, The Farm at Eastman's Corner has offered delicious, locally-sourced food and beverages in a welcoming rural atmosphere, all while allowing visitors to interact with and learn from the various sustainability measures that it utilizes on a daily basis.

Upon arriving at The Farm, visitors are greeted by solar panel arrays on not one, but both sides of the street. The main area of The Farm consists of several greenhouses, animal pens and the Farm Store, which has had a rooftop solar array since February 2014 that generates over 14kwh annually, meeting 10% of the onsite electric load. Beyond the greenhouses are a series of nearly two dozen pole-mounted solar arrays, which were first installed in May 2015.

Across the street from the Farm Store is the building that serves as The Farm's culinary team's headquarters, known as the Food Barn, which has had a rooftop solar array since February 2015. This array produces 13.7kwh annually, meeting a third

of the building's energy needs.

The Farm at Eastman's Corner also has solar-powered level two electric car charging stations, which were the first of their kind in the state of New Hampshire when they were installed in 2016. The Farm has worked with ReVision Energy on all of these solar projects.

Composting is another key element of life at The Farm. Organic waste generated at the Farm Store is composted using a Mr. Fox Composting bin, which the Mr. Fox Composting Company empties out each week. The Farm also has a separate compost pile for material that stays on the property in order to be used for landscaping purposes.

Sustainability even plays a role in the upkeep of The Farm's buildings. The Farm uses low-VOC paints, which are paints that are low in volatile organic compounds or carbon-containing solvents and other ingredients that easily evaporate.

When it comes to what food products are sold and served at The Farm, The Farm prides itself in supporting the local economy and the environment by locally sourcing as much food as they can in order to eliminate superfluous transportation emissions from their carbon footprint. The Farm's



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goal is to make their chain of supply as tight and efficient as possible with a goal to source 80% of their products from either the Farm itself or within twenty miles of Eastman's Corner. The Farm also grows its own produce, such as fresh greens, ginger, garlic and tomatoes, throughout the year using their eleven greenhouses.

In addition to providing guests with quality products and a memorable experience, The Farm is also committed to educating guests about sustainability. Guests can learn about the on-site solar panels through informational signs as well as a monitor in the Farm Store that tracks the energy yield of its rooftop array in real time. The Farm also hosts a variety of free events including lectures and workshops, where community members can learn about topics such as land conversation and sustainable living.

Of all the members of its local community, The Farm is especially focused on educating and supporting children. Through special events and programs designed for children, The Farm hopes to instill children with a greater respect and appreciation for natural resources and the environment. At The Farm, children can meet local farmers, build bird house and interact with The Farm's goats. On top of all of this, The Farm donates 5% of each sale and 100% of their profits to Sawyer Park, a 30-plus acre, family-focused public park in Kensington, NH.

Regardless of whether you are young or old, if you make a trip to The Farm at Eastman's Corner, it's bound to be a good one.

The Farm at Eastman's Corner is located at 267 South Road, Kensington, NH and open daily, year-round. For more information, visit eastmanscorner.com.

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

A Defense Against Extreme Weather is Underfoot

By Andrea Basche



A soil scientist and a farmer inspect a Daikon radish cover crop grown as part of a federally funded sustainable agriculture research project. This plant's roots penetrate soil deeply, reducing compaction and increasing water infiltration. (SARE.org)

If you have read *The Grapes of Wrath*, you'll remember the catastrophic dust storms that arose in the United States during the droughts of the 1930s, causing farmers to abandon their land. These real events were driven by short-sighted farming practices that resulted in crop failures and bare soil that blew all the way to Washington, DC.

Today, similar shortsightedness—the practice of intentionally leaving fields bare much of the year—is once again making U.S. farmers and their surrounding communities vulnerable to extreme weather including droughts and flooding. Faced with increasing rainfall variability and the damage it can cause, farmers and policymakers should take steps now to protect soil and prevent the worst Dust Bowl-like consequences. In the new Union of Concerned Scientists (UCS) report, "Turning Soils into

Sponges," we examine how smart farming practices can build rich, porous, sponge-like soils to help minimize the effects of both floods and droughts. Healthy, spongy soil holds more water, allowing it to reduce runoff during rainstorms and to hold water longer during dry periods. By analyzing 150 field experiments from around the world, we found that keeping living roots in the soil year-round is a highly effective way for farmers to create valuable sponge-like soil. Farmers can achieve this by planting perennial crops and cover crops, as well as through improved livestock grazing practices. We also used a hydrology model to predict how much difference these practices could make if adopted on a large scale. Focusing on the state of Iowa as a representative example of Midwestern agriculture, we showed that planting perennial or cover crops on the most-erodible croplands in the state would reduce rainfall runoff up to 20% in flood conditions, and make as much as 16% more water available to crops during droughts.

Unfortunately, while many farmers are interested in building healthier, spongier soil, they face barriers in policies that make it riskier

and less profitable for them to try. Congress and the U.S. Department of Agriculture can make it easier for farmers to adopt these beneficial practices through greater investments in research and technical support and changes to the federal crop insurance program.

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and less profitable for them to try. Congress and the U.S. Department of Agriculture can make it easier for farmers to adopt these beneficial practices through greater investments in research and technical support and changes to the federal crop insurance program.

Even as climate change presents new challenges for farmers, soil can be an important part of the solution to minimizing flood and drought impacts—and creating a more sustainable U.S. agricultural system. Find our report, along with a fun video demonstrating how healthy soils can mitigate the effects of droughts and floods, at www.ucsusa.org/SoilsintoSponges.

Andrea Basche, a specialist in sustainable agriculture, is a former UCS Kendall Science Fellow.

Reprinted with permission from the Union of Concerned Scientist's newsletter, *Catalyst*, Volume 17, Fall 2018. Learn more at www.ucsusa.org.



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AWEB Supply, Geothermal Pioneer

By George Harvey



A Slim Jim® 40 ton (HR) "POND LOOP IN A PACKAGE" consisting of four SJ-10T plates assembled with frame on skids, 3" manifold and 3" flange connections. Courtesy photo.

them cumbersome and labor intensive, and difficult to install. They also had large surface areas, so silt could easily build up on them, reducing their efficiency with time. And this meant that they had to be lifted off the bottom every few years to have the silt washed off.

Watts' moment of illumination came as he saw clearly a better way. And with his new understanding, the Slim Jim® and Geo Lake

Plate® systems were born, introduced in 1999.

Watts' new approach was to make the AWEB Slim Jim® heat exchangers out of 304 stainless steel. For more corrosive sites such as salt water, where there could be corrosion issues, the Geo Lake Plate® systems are made out of titanium. These metals have high thermal conductivity, so the systems made from them can be much more compact and easier to install. They stand vertical and give silt no opportunity to get in the way. For specialty applications, Geo Lake Plate® is available in 316L Stainless.

Because the AWEB Supply heat exchangers are made of stainless steel or titanium, they are a little more expensive than the plastic exchangers they replace. But the beauty of the systems can be seen when the overall cost of installation is calculated. Because they are compact, with relative ease of installation, the overall cost of the system is reduced at installation. They are also less expensive to maintain.

There are numerous examples of Watts' systems, both in the United States and elsewhere. The largest Slim Jim® system installed, believed to be the largest of its kind in the world, was at Nashville International Airport. The airport expected to save \$400,000 per year on air conditioning but found it was doing much better, possibly double that amount (<http://bit.ly/NIA-AC>).

Alan Watts had seven years' experience in heating and cooling when he designed his first geothermal project in 1981. It was a simple system, with open discharge on a water well, but it had a profound effect.

"Once I did that one system," Watts said, "it kind of bit me, and I've been involved ever since."

Green Energy Times now has published numerous articles on geothermal heating. One dealing with water as a heat source, "Geothermal Heat Pump with a Pond Loop," appeared in April, 2015. (<http://bit.ly/GET-pond-loop>)

In a pond loop system, a heat pump extracts heat from the water, though it may be cold, and releases it into the building being heated. It is rather like the system we all know that extracts heat from inside a refrigerator releases it into the kitchen. The units heating buildings, however, can usually be run for air conditioning as well.

There are several kinds of heat pumps. They are among the most efficient systems available for heating and cooling, and the least expensive to run. Geothermal heat pumps are much more efficient and inexpensive to run than air-source heat pumps. Those using surface water as the heat source are the simplest and least expensive geothermal systems to install. The only thing that can obviously beat such a unit for low pollution and operating cost is not heating or cooling at all.

Alan Watts saw clearly the advantages of geothermal systems from the start. Increasingly, he focused his attention on them, and he established AWEB Supply in 1984. Within only a few years, he became a distributor of geothermal equipment for a major manufacturer and began establishing a network of geothermal dealers by working with and assisting in design of systems.

The heat pump may be the core component of its system, but the heat exchanger that extracts heat from the environment is equally vital. Watts first supplied ClimateMaster and then WaterFurnace heat pumps, which are carefully engineered and manufactured systems. But he could see that the heat source, in the ground or the water, requires special, local expertise for any installation to be of the highest quality. As good as the systems using surface water as heat sources were, there were shortcomings that Watts was aware of. He wanted to make geothermal simple and labor-friendly.

Conventional technology had systems made of plastic because of its ability to hold up in the environment. Plastic, however, is a poor heat conductor. Because of this, the heat exchangers in the water had to be large, usually consisting of many loops of semi-flexible pipe which made

AWEB Supply has discontinued distribution of heat pump equipment and supplies so they can concentrate their energies on making Geo-Exchange "As Simple as It Gets!" with the Slim Jim® and Geo Lake Plate® exchangers.

AWEB Supply's web site is <http://www.awebgeo.com>. You can view their ad on the back page.

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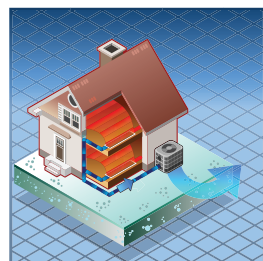
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A Brief Intro To Climate History

By Rick Wackernagel

Earth's climate has been changing for a long time. One way to assess the significance of current changes is to compare them to past changes. Two important measures to compare are atmospheric temperature and carbon-dioxide (CO₂) concentration. Temperature is both an indicator and a determinant of climate. It influences how much moisture and energy Earth's atmosphere contains. Average annual global temperature is a common measure. It is often expressed as a temperature anomaly, the difference between one annual temperature and the average during a reference period, here 1951-1980. For example, the 2017 global annual average temperature anomaly of 0.90°C means the temperature that year was 0.90°C above the average temperature from 1951 to 1980. Recorded temperatures start in 1880. Estimates of temperatures back about 540 million years have been made using pollen in lake sediments, tree rings and other indirect indicators.

Climate scientists have found that the CO₂ content of the atmosphere influences global temperatures. CO₂ reflects infrared radiation coming from Earth so the radiation returns to Earth, rather than escaping into outer space. The CO₂ content of Earth's atmosphere has been measured since 1958. Air bubbles trapped in glacial ice, and concentrations of boron and carbon isotopes in marine sediments have allowed scientists to estimate atmospheric CO₂ back about 540 million years, too.

The graphs here show changes in Earth's climate that scientists have observed. Temperature differences, or anomalies, are defined as above. Their baseline in the graph is 0°C. CO₂ concentrations and fossil-fuel emissions are expressed as percentages of their 1951-1980 levels. Their baseline is 100%.

Reconstructed temperatures decline from 800 to 1740 AD, bottoming out at -0.37°C in 1740, i.e., 0.37°C below the 1951-1980 base. These reconstructed temperatures are smoothed and given in 10-year intervals. Temperature records beginning in 1880 are annual and show a lot of year-to-year variation. The average temperature anomaly for the 1736-1765 pre-industrial period is -0.26°C. Temperatures rise irregularly from roughly 1900 to 1967, with a spike in 1944. After 1967, they rise more consistently and rapidly, on average 0.018°C per year. The 2017 global temperature is 0.90°C above our baseline and 0.09°C below that of 2016, when an El Niño occurred.

The CO₂ content of the atmosphere is usually expressed in parts per million (ppm). During our baseline period, it averages 323 ppm. CO₂ levels are relatively stable from 800 to 1830 AD. From 1837 to the present, CO₂ levels only rise or stay the same. They never go down. At 405 ppm in 2017, it is 26% above the baseline, and 46% above the pre-industrial average, 281 ppm.

Fossil-fuel emissions, measured in million metric tons and based on records of fossil-fuel extraction beginning in 1751, are also expressed as a percent of the 1951-1980 level. These emissions come from human activities. They start at 11 million metric tons per year in 1751, or 0.1% of baseline emissions. In 1946, they begin increasing strongly. In 2016, the latest year available, 36 billion metric tons of CO₂ were emitted, 191% above the baseline.

Fossil-fuel emissions, CO₂ levels and

temperatures are positively correlated, with the most striking correlation between CO₂ emissions and temperatures from 1967 to the present.

Expanding the time period back to 28,000 years BC reaches the last glacial period. Temperatures bottom out at 9.82°C. While their total rise into the interglacial period is much greater than the rise since our baseline, it is much slower. At their most rapid, at 10,000 years BC, they rise at 0.20°C per 50 years. In the 50 years from 1968 to 2017, they rise 0.98°C. Over these 30,000 years, CO₂ levels rise slowly while temperatures rise, then

stabilize until close to the present.

The 800,000-year record shows temperature and CO₂ levels rising and falling in a highly correlated, somewhat cyclical pattern. Peaks represent interglacial periods and valleys glacial periods. They correlate well with oscillations in the Earth's orbit, rotation and axis, known as Milanković cycles. A long-term decline in atmospheric CO₂ is thought to have brought Earth's temperature down to a level at which the Milanković cycles could cause alternating glaciation. Temperatures drop to almost 10°C below the baseline and rise to nearly 4°C above. Even here, the

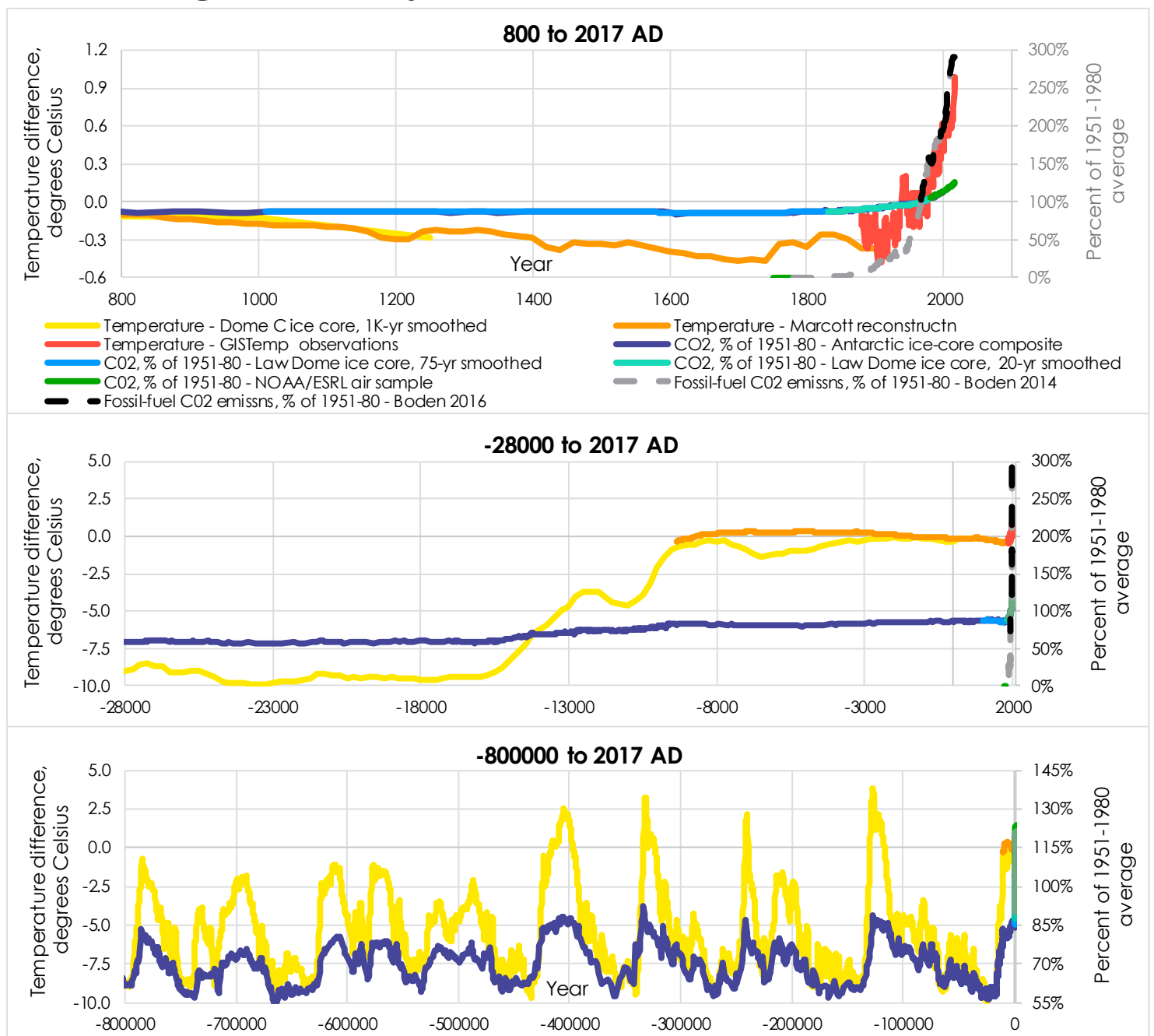
most rapid increase in temperature is 0.34°C per 50 years, much less than our 0.98°C.

Changes in CO₂ levels also differ distinctly from recent experience. At no time prior to 1966 do CO₂ levels reach our baseline. The highest CO₂ level before 1 AD is 299 ppm, or 94% of the baseline. At 405 ppm, 2017 is 34% higher.

In summary, recent changes in temperature and CO₂ levels are more rapid than in historical climate data.

Rick Wackernagel, itinerant climate activist.
Email: rick.wackernagel@gmail.com.

Atmospheric CO₂ levels, fossil-fuel CO₂ emissions and global temperatures, relative to 1951-1980



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By Rick Wackernagel, PhD, Itinerant climate activist. Email address: rick.wackernagel@gmail.com. The latest version of this poster is available at bit.ly/ClimateHistoryGraph-Ltr. Suggestions welcome. This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/). You may copy, distribute or mash it up, as long as you provide attribution to the source.

4/11/2018



America's Accelerating Population Predicament: Exponential Growth Consequences

By Frosty Wooldridge

This column is the first of a new series about an issue that the author believes is the biggest issue that we need to address. The problem is the accelerating population—a predicament that needs to be talked about as we attempt to find solutions for this changing planet. In the end, we want to see our children and grandchildren be able to survive with what we are leaving them with.

Part 1: Quotes that make impact on America and around the world, denial, displacement, ignorance.

Nobel Laureate Dr. Henry W. Kendall said, "If we don't halt population growth with justice and compassion, it will be done for us by nature, brutally and without pity – and will leave a ravaged world."

What did he mean by that rather abrupt if not deadly statement? How can one of the few human beings on the planet who earned a Nobel Prize come to such a deliberate understanding? Why don't more humans recognize the same reality facing humanity in the 21st century?



Humanity digs and carves the planet up for the remaining resources which dwindle while humans continue on their growth rampage. Image: ped203health3.wikispaces.com.

As a world bicycle traveler across six continents, I witnessed firsthand what Dr. Kendall expresses in his statement. One look at China and India gives you an idea of the consequences of "exponential growth" at its end-most destination. Even worse, Bangladesh supports 157 million people in a land area the size of Ohio. Can you imagine half the U.S. population living in Ohio? Can you imagine the ecological damage as to shortages of drinkable water, sewage pollution, carbon emission exhausts, growing food to fill the bellies of those 157 million impoverished bodies, not to mention human crowding and loss of any quality of life?

Kendall talks about halting population growth with "compassion and justice." What does that mean? Answer: it means humans need to take their fertility rates into their own hands and provide for birth control that brings human populations into balance with the carrying capacity of the planet. Exponential growth cannot and will not be tolerated by Mother Nature. She already starves to death over 10 million children annually and another eight million adults. (Source: United Nations) That is the "...will be done by nature, brutally and without pity..." aspect of Dr. Kendall's statement.

What constitutes exponential growth? The term means: endless growth of any organism. That growth ultimately results in overwhelming the carrying capacity of area in which it thrives and, finally, collapse and possible extinction of that species.

As it stands today, according to Oxford University's Norman Myers, human encroachment upon worldwide habitat causes the extinction of 80 to 100 species daily. That means those creatures no longer exist because humanity overwhelms its own carrying capacity and destroys the food, water and living area for other species. Thus, humanity creates the most dangerous aspect of Mother Nature's "carrying capacity" limits. The current rate of extinction within the United States runs at 250 creatures annually, according to the U.S. Department of Interior.

Collapsed civilizations litter history books: Easter Island, Mayan Empire, Incas, Anasazi, Vikings, Rwanda, Haiti and more to come. Read Jared Diamond's *Collapse: How Societies Choose to Fail or Succeed*.

Those civilizations collapsed via exhaustion of food or water, i.e. they overwhelmed their carrying capacity.

Today, nearly all of humanity overrides its carrying capacity in oil-driven and oil-fed countries. Without oil, the United States could not exist with its 328 million inhabitants. Without the gasoline-filled tractors

million; New York City with 19 million; Mexico City with 20 million; Bombay with 20 million; Sao Paulo with 20 million; Delhi with 22 million; Tokyo featuring a staggering 36 million and all the other overloaded cities around the world—it becomes obvious that humanity cannot exist without oil—but oil will soon vanish. To say it's going to get ugly with that many people bunched up in those cities may be the understatement of the 21st century.

At the end of Kendall's statement, he said, "...and will leave a ravaged world." You may appreciate the "Seven wonders of the world" created by human beings. Glorious triumphs of architecture and human engineering! However, we could add the "Seven tragedies of the world" created by humans such as the Great Pacific Garbage Patch, Sixth Extinction Session, Overly polluted Biosphere, Acidified and Destroyed Oceans, Acid Rain Phenomenon, Destruction of Worldwide Rainforests, Human Misery Index and more to come.

We may prove ourselves a clever species, but none too smart. None too reasoning. None too proactive.

Can America lead the world in this quest for a sustainable future? Can it change its course from its current overload of 328 million on its way to 625 million within this century and probably on toward one billion in the first part of the 22nd century?

As Dr. Kendall stated, "If we don't halt population growth with justice and compassion, it will be done for us by nature, brutally and without pity – and will leave a ravaged world."

We need to get busy in order to provide a livable world for all creatures including ourselves.

Frosty Wooldridge, a math-science teacher in Golden, Colorado, bicycled across six continents in the past 46 years to see human overpopulation up close and personal. He speaks to colleges, civic clubs, political clubs and more nationwide. [www. HowToLiveAllLifeOfAdventure.com](http://www.HowToLiveAllLifeOfAdventure.com); frostyw@juno.com



Oil spills and oil drilling create endless damage to our biosphere and to wildlife worldwide. The grease job on this pelican caused his death. Image: Flickr.



Humans spill toxic oil by the millions of barrels into our oceans and across the land by dumping it without concern. Image: Boston.com.



The famous BP oil spill was the largest marine oil spill in history. The disaster was caused by an April 20, 2010 explosion on the Deepwater Horizon oil rig located in the Gulf of Mexico. Image: fisherynation.com.



Humans create electrical energy by burning billions of tons of coal that pollutes the atmosphere that creates air polluted cities and acid rain that destroys top soil and acidifies our oceans that kills marine, avian, plant and reef life. With endless population growth, it can only worsen beyond solving. Image: Wikipedia.

Lessons from Winter – A Snowy Winter Gives Way to Spring

By Dr. Alan K. Betts



It has been a chilly and snowy winter in the northeast. While temperatures in the western U.S. and Alaska have been above average, temperatures in the Arctic

have been very high, and the sea-ice cover has reached record low values. As the Arctic warms, the cold polar vortex weakens, and it has become more unstable. There were large exchanges of warm air flowing into the Arctic, and cold polar air sinking into eastern North America and into Europe in March. These air-mass exchanges produce both our cooler winter and the warmer Arctic.

Snow cover also locks in cold temperatures, because it reflects so much of the sun's energy that little snow can melt, until the sun is higher in the sky. But the winter has had some extreme transitions. When warm air came in from the south on January 11-12, temperatures which had been below zero soared to 60 degrees. The snow all melted, and to my surprise, the soil was unfrozen. I could dig under some of my cover crop.

By late March, we were eating spinach that overwintered in a glass cold frame, mostly buried under snow. Our spring lettuce will soon be ready. The local farmers' market has had mixed salad greens grown in unheated tunnels since mid-February.

Last December, the fuel efficiency of our Prius Prime plug-in hybrid dropped below 100mpg for the first time. The battery is less efficient when it is cold, as 20% of its energy is used to heat the car. In contrast, we average 160 mpg in summer with a mix of short and long-range trips. Our average on the first 14,000 miles is 134 mpg, which means

we are burning only 90 gallons of gas per year. Plug-in hybrids reduce carbon emissions by 80% and are available now.

The global trade issues are in flux. The European Commission has backed a French call to make trade deals with Europe contingent on membership of the Paris climate agreement. This is a step forward towards global responsibility. And a small step towards holding the U.S. government responsible for sacrificing the Earth's climate to protect the financial interests of its fossil carbon sponsors. However, our president believes he can control trade using tariffs, so trade wars threaten.

The deeper economic issue is that climate change denial is driving a huge fossil-carbon bubble. We face the collapse of the perceived value of fossil carbon assets and related industries, as well as the value of coastal property threatened by storm surges and sea level rise. Trillions of dollars of assets will lose their value as climate change accelerates in the coming decades.

At town meetings last month, thirty-five Vermont towns voted overwhelmingly in favor of resolutions seeking climate solutions. They urged the State of Vermont to meet its goals for 90% renewable energy and called for a fair and equitable transition off fossil fuels. The majority of the resolutions also demanded a ban on any new fossil fuel infrastructure, such as natural gas pipelines. This is a stark but encouraging contrast with federal policy.

I am reminded how Vermont conservatives realized long ago that conserving the



Snowy winter in Pittsford, Vermont in mid-March. Photo: Alan Betts

natural resources of the Earth was crucial for our society. Yet strangely in our nation's capital, many that claim to be conservatives do not see that conserving the climate of this planet is crucial for future life on Earth. Morally blind, they would sell our children's future to those who fund their election campaigns.

Yet spring is here again, and I have the delight of planting frost-hardy seeds and transplants to rejoin the cycle of life for another summer.

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

A SLOWING GULF STREAM

By George Harvey

There are some things nature brings us that we feel we can count on, such as the warmth of summer and winter snow. We depend without thought on rain to grow our crops.

Perhaps most of us have never heard of the Year without a Summer. (bit.ly/wikipedia-year-without-summer). That year, 1816, global temperatures were 0.7°F to 1.3°F below normal, probably because of volcanic activity. That might not sound like much, but it left the weather so unstable that there were damaging frosts every month in much of the United States. In some places, even hay could not be harvested. It was a worldwide phenomenon, and millions of people starved. It was a small change with big ramifications.

Scientists have known for a long time that the Gulf Stream was not moving quite as fast as it had in the past. That was not necessarily anything to worry about, because there are always variations in such things. In the last couple of weeks, however, many scientists seem suddenly to have become very worried.

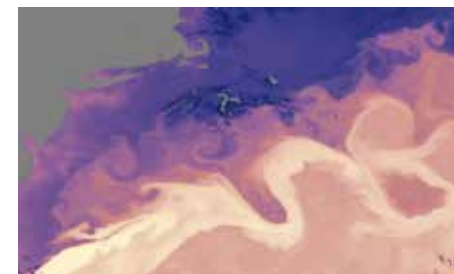
The Gulf Stream is part of the Atlantic Meridional Overturning Circulation (AMOC). Because of a combination of the warmth of the sun, the cold of space, the spin of the Earth, and other factors, warm water from the Gulf of Mexico flows north and east, eventually passing north of Europe. Any cold weather from the Arctic has to pass over the warm water, and this modifies the temperatures in Europe. That is why the French grow grapes for wine instead of apples and blueberries, though Paris is considerably farther north than Montreal.

Two recently published scientific papers agree that the AMOC has slowed down much more than had been believed. In fact, it has slowed to about 85% of the slowest point measured or estimated in the past 1600 years. The scientists say that at least part of the slowdown must be linked to human causes.

The models for the AMOC are very complicated, and this may explain why their projections were wrong. The water melting from the Greenland ice is fresh, so it spreads across the top of the ocean water, potentially covering warmer salt water with a colder surface. Water contracts as it cools, but only until it gets to 39° F, below which it expands as it cools. So the salty ocean water goes to the bottom at that temperature. Even so, it is worrisome that the models do not even hint at such a slowdown. That fact suggests that we are in territory that is not merely uncharted; it was not even imagined.

Scientists believe that the AMOC was disrupted during the last Ice Age badly enough that temperatures fell 5°C to 10°C (9°F to 18°F) over the course of only two to three years. That would mean that temperatures in Paris might drop to those of Bismark, North Dakota in a short time. Compare that change with the Year without a Summer, when the difference was less than 2°F.

I hope they are wrong. But we must be prepared for their being right.



Flow of the Gulf Stream. NASA image.

Vermont Research Climate Change News

Maple Syrup, Climate Change, and Sustainable Agriculture



Image: pxhere.com

The authors concluded that "In the end, these results illustrate a broader application of considering climate change vulnerabilities of species alongside important ecosystem services, and can facilitate adaptability planning of forest resources in the face of accelerating climate change."

Read the full report at: <http://bit.ly/Sugaring-climate-change>.

MAPLE SYRUP – CLIMATE CHANGE

Vermont is the leading producer of maple syrup in the U.S. But could this change with the impacts of climate change? A recent study looks at changes in sap flow and sugar formulation as trees adapt to a changing climate. The study states that there is a "Potential change in sugar maple habitat and syrup production," and that the "sugar maple habitat is expected to decline in most parts of its current range by 2100, although being a long-lived species, it remains to be seen how a decline in suitable habitat translates to a decline in abundance by then."



Image: Flickr.com

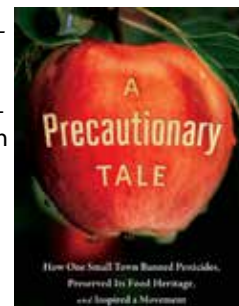
SUSTAINABLE AGRICULTURE

In the recently published *A Precautionary Tale*, author and Green Mountain College professor Philip Ackerman-Leist recounts how Mals, a remote agricultural city in the Italian Alps, became the first place in the world to ban pesticides. Thanks to a diverse cast of characters, from farmers to doctors, the town voted to protect its organic crops from nearby "Big Apple" pesticide-intensive apple producers. Ackerman-Leist, who founded the college's farm and sustainable agriculture curriculum, draws upon his own experience as a farmer in the Italian region, and currently on his South Pawlet farm.

Learn more at <http://bit.ly/A-Precautionary-Tale>.

Reprinted with permission from the Center for Research on Vermont, February 7, 2018 edition of Vermont Research News.

Links available on the individual posting of this article on our website: www.greenenergytimes.org.



Aging In Place - With Grace

By Barb and Greg Whitchurch



The Floersch home in Berlin, VT with solar PV field in the background at the right. Credit: Larry Floersch.

Smack dab between Montpelier and Barre, VT lies the tiny Knapp Airport (KMPV) in Berlin. Not far from its north-south runway sits a cozy little house, almost completed, that will be the home of Larry and Barbara Floersch, a semi-retired couple who lived in East Montpelier for 32 years. The view allows one to watch small planes take off or land in front of the mountains to the northeast. The house is atop the highest hill in the area - a rural, wooded spot, but also near the hospital. The sun rises over the distant mountains; a farm sits off to the south; but no other houses are visible.

The Floersch chose this spot and designed the house for aging in place. The home is a single floor with no steps or stairs outside or in; it's ADA accessible. The cathedral-ceilinged living/dining room opens through a full-light door to a screened-in porch area designed for viewing, barbecuing and entertaining.

Beyond the layout and style issues, they wanted their home to be well-insulated and cozy; to be awash in fresh, filtered air; to be filled with natural light; and to be efficient enough to keep the costs of operation under control. To accomplish these wishes, they had to find a builder up to the task. This hurdle

is faced by all prospective homeowners: how to distinguish someone who's qualified from another whose honest and speaks well of themselves but is not qualified. Just seeing the outside of a completed home, perhaps its inside finishes, and maybe talking to selected "satisfied" customers who don't understand the hidden details and complexities of modern construction won't do the trick.

To help address this problem, the building science experts at Efficiency Vermont (EVT, <https://www.efficiencyvermont.com/>) created the Efficiency Excellence Network (EEN <http://bit.do/EVT-EEN>) to provide training to contractors and give customers a place to go to find knowledgeable, competent tradespeople - Montpelier Construction is a member (www.MontpelierConstruction.com). In addition, the Floersch's builder, Malcolm Gray (a partner at Montpelier Construction), has been trained as a Certified Passive House Consultant and is certified as a "High Performance with Energy Star" builder by the BPI (Building Performance Institute). Employing the criteria above will put one on the right path toward a successful project.

Malcolm entered this project into EVT's High Performance Home (HPH) program (<http://bit.do/EVT-HPH>). This program requires that a home attain specific levels of efficiency and meet modern building standards. It DOES NOT require state-of-the-art, over-the-top expenditures or owner's-hand-tied limitations on design choices. It doesn't even require passive house levels of efficiency. But it is a step or two ahead of what's still commonly being constructed out there, a bit above the building code, and it will meet the Floersch's needs and expectations regarding comfort, health, cost of ownership and cost to operate.

Back to EVT's High Performance Home Program: it also provides substantial monetary incentives to the homeowner and invaluable free assistance to the

Cont'd on p.27 >>



The view from the interior framework of the Floersch home in Berlin, VT with the solar field in the distance. Credit: Larry Floersch.



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Aging In Place

<< Cont'd from p.26

builders from the experts at EVT in most phases of design and construction. EVT's parent, VEIC (VT Energy Investment Corp.), was the first utility of its kind in the nation; it operates sister utilities in Ohio and Washington DC; it is supported through your utility payments; and it is considered the model for efforts of this kind everywhere.

Now, back to the home: it is 1350 sq. ft., 3-bedroom, 2-bath; has R-30 under the foundation slab; R-40 walls; R-80 ceiling; triple-pane, passive house-level Klearwall windows and doors; an Ultimate Air ERV for fresh air; and an 18kBTU air-source heat pump. (There are rebates and incentives on some of this equipment.) It has a gas range and fireplace. It is small enough to feel cozy, while open enough to feel spacious. It's net-zero-able and represents a point on the path toward passive house.

Note: You might wonder why Green Energy Times is featuring a house that uses fossil fuels for heating and cooking. This house has a good envelope and will be around for many decades - it doesn't need the gas fireplace for heat. And, as regular readers know, a quicker, safer, 80% more efficient induction range can be had for \$1300 (with a big convection oven).

Barb and Greg Whitchurch are board members of Vermont Passive House and owners of a LEAF, a Prius and a net-zero passive house with solar PV and hot water in Middlesex, Vermont. <http://bit.ly/2nRCdGL> (802)223-2416.



The Floersch home in Berlin, VT - work progresses through all kinds of weather. Credit: Larry Floersch.


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Weatherization Targets the Most Vulnerable

WITH NO-COST SOLUTIONS TO HOME ENERGY

By Becky Himlin



Harald O'Brien, Weatherization Crew Chief, stands next to one of SEVCA's weatherization trucks, parked on-site at a home in Brattleboro. Courtesy images: Becky Himlin, SEVCA

Increasing costs for basic necessities coupled with stagnating or reduced real income over time is a recipe for increasing hardship and inequality. Energy is one area where costs have risen dramatically compared to income over the last several decades. Added to this, the poorer quality of housing available to low-income families in Vermont is often uninsulated and inefficient, resulting in higher costs for home heating and cooling. The result is severely disproportionate energy burdens for low-income households. Those earning from 50-100% of the Federal Poverty Level (FPL) in Vermont are estimated to have home energy bills amounting to 25% of their income, and those who earn less than 50% of the FPL pay almost half their income (Fisher, Sheehan and Colton, 2016).

But there is at least one aspect of this bleak picture that offers some hope, one in which Vermont is one of the leaders in the nation—the increased focus on sustainability of our energy resources, particularly the commitment to increasing home energy-efficiency. And far from “freezing out” households with low incomes, Vermont has invested in programs that specifically target these households. The Weatherization Assistance Program (WAP), is offered through five regional agencies, four of them being the state's Community Action Agencies, including Southeastern Vermont Community Action (SEVCA). These agencies function at the cutting edge in terms of offering sustainable, energy-saving solutions for some of our most vulnerable households at no cost to them. SEVCA's general services area consists of Vermont's Windham and Windsor Counties. Other agencies cover the remainder of the state. This program receives some funding from federal appropriations, but the majority of its funding comes from a consumption-based state tax on heating oil, propane, and kerosene. While funding has not nearly reached the level that will enable the state to achieve its goal of 80,000 homes weatherized between 2008 and 2020 (the goal set when the Vermont Energy Efficiency and Affordability Act was passed), it is having a significant impact.

Benefits for the residents of homes and apartments that are weatherized through WAP are dramatic and immediate—they save an average of 24.5% on their energy costs every year (Office of Economic Opportunity report to the Vermont State Legislature, January 30, 2018). Households whose homes were weatherized in the previous fiscal year and who used oil for heating were estimated to have savings of \$442/year (based on last year's lower oil price of \$2.27/gallon). Plus,

there are huge benefits for our environment. According to a report by the Thermal Efficiency Task Force, fossil fuels used in buildings are the second-largest source of greenhouse gas emissions in Vermont, and weatherization is recommended as the most important, cost effective intervention to address that. The estimated reduction in carbon released into the atmosphere for the 893 homes weatherized by WAP in FY17 alone was 1,592 tons per year—add to that the cumulative carbon savings from all of the units weatherized in previous years (the program has been active since 1973),

and it's clear that WAP makes a considerable contribution to reducing greenhouse gas emissions.

Yet these impressive benefits are only the beginning. By partnering with Efficiency Vermont, WAP is working to simultaneously improve thermal and electrical efficiency. Each household scheduled for weatherization services is visited by an “Efficiency Coach,” who explains the entire weatherization process and also does an assessment of various efficiency improvements the household is eligible for, from simple things like LED light bulbs to appliances like heat pumps, energy-efficient refrigerators, and “mini-splits” for heating and cooling. The Efficiency Coach can install some items at this visit, like bulbs, low-flow shower heads, and energy-efficient power strips that fully shut off unused appliances. A crucial aspect of the service is talking to clients about behavioral change. “The most important part of what I do is talk to them about the impact of lifestyle changes on their energy costs,” says Victor Baisley, SEVCA's Efficiency Coach. “For example, hot water can be one of the major factors in high electricity bills, and I tell them how much they can save if they do their laundry in cold water or take shorter showers.”

The Efficiency Coach is also the point person for another important state intervention—the One Touch program, which generates referrals to numerous health and basic needs programs based on an intake survey of weatherization clients. The survey identifies people who don't have health insurance, might have a high risk of falls, suffer with asthma, want to stop smoking, etc., and connects them to relevant programs that can help them. “We're in their home, and that gives us the opportunity to develop a relationship with the client; one of the first things I do during my visit is to make the client feel at ease,” says Baisley, so much so that most agree to participate in One Touch and are glad to find out about these resources. Last year, Vermont's program won a HUD Healthy Homes Award for their efforts to deliver health and home improvement interventions in an integrated way.

Weatherization itself generates longer-term direct and indirect health benefits to residents as well as extending the life of the home. The whole-home approach WAP utilizes helps keep homes at a comfortable temperature while minimizing hazards like mold or other air pollutants in the home (triggers for asthma or exacerbating factors for emphysema, for example), or ice dams on the roof (leading to damaged or leaky roofs). This

helps protect low-income households from having to cope with unexpected health care or home repair expenses that perpetuate the vicious cycle of poverty.

Despite all of the persuasive arguments in support of increased funding for weatherization, the program continues to be vulnerable to budget cuts. The recent Trump administration budget for FY18 zeroed-out the program; luckily, Congress maintained its support for WAP and provided for \$251 million for the program, a 10% increase, in the recently enacted omnibus appropriations bill. Meanwhile, the State of Vermont hasn't demonstrated a commitment to appropriating the funding needed to meet its own goal for weatherization, though organizations like Energy Independent Vermont and Energy Action Network are pushing for just that.

Miguel Orantes of Bellows Falls received Weatherization assistance from SEVCA at a low point in his life, when he had been waiting for months to receive disability benefits after a debilitating accident, followed by a serious illness. Prior to weatherization, he said he needed four cords of wood plus oil heat to stay warm, and it was much more than he could afford. Now that his home is weatherized, even with the cold winter we're experiencing this season, he says he doesn't expect to use more than half a cord of wood, and his oil bill is “almost nothing.” “It's ridiculous to live in an uninsulated home in New England,” Miguel says. “The weatherization program is a necessity, not a luxury. Cutting it is simply not sustainable.”

We couldn't agree more! Vermont has invested much, but could still do more to bring the financial and environmental benefits of weatherization to all residents. In the longer term, as the impact of climate change promises to be ever more devastating, home weatherization and efficiency measures need to increasingly become one of our national priorities.

To find out if you qualify for SEVCA's no-cost Weatherization Assistance Program, contact Tawny Staskunas at tstaskunas@sevca.org.

More help can be found at:

- Home Energy Affordability Gap—Fisher, Sheehan & Colton: <http://bit.ly/HomeEnergyAffordabilityGap>
- Thermal Efficiency Task Force report: <http://bit.ly/ThermalEfficiencyTaskForceReport>
- HUD Healthy Homes 2017 awards: <http://bit.ly/HUD-HealthyHomesAward2017> and <http://dcf.vermont.gov/news/7-25-17>
- Energy Action Network: <http://eanvt.org/>
- Energy Independent Vermont: <http://bit.ly/EnergyIndependenceVermont>

Becky Himlin is the Director of Planning and Development at Southeastern Vermont Community Action (SEVCA). She can be reached at bhimlin@sevca.org or 802-722-4575.



Miguel Orantes of Bellows Falls received much needed weatherization assistance from SEVCA.



David Mack, Weatherization Crew Technician, drills a hole for the installation of a bathroom ventilation fan, which helps prevent mold in a weatherized home.



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INTUS: ONE WINDOW, ONE TREE CAMPAIGN — AND A LITTLE SOMETHING ABOUT WINDOWS

By Greg Whitchurch

Intus Windows will launch its “One Window, One Tree” campaign on Earth Day, Sunday, April 22. For every commercial window sold, they will sponsor the planting of a tree, to contribute toward offsetting the carbon footprint of the building.

The Windows.

Intus manufactures passive-house-quality triple-pane windows and doors and they are partnering with tree-planting organizations to plant the trees near the facility where the window was installed. More information is available at their website <https://www.intuswindows.com/>.

Although at this time Intus only supplies windows to commercial projects, let’s talk about how one might check into a window’s specifications for residential projects, too. The National Fenestration Rating Council (<http://www.nfrc.org/>) is a U.S.-based organization that tests and rates windows and doors. Until very recently, some top-line European windows have been considered the best of the best, as far as both highest performance and most reasonable cost are concerned - and with good reason. But there are American and Canadian competitors entering the market.

A window’s ability to keep heat in (or out) through its thermal resistance is reflected in its U-value (<http://www.nfrc.org/energy-performance-label/>). Here in the U.S. we typically speak of R-values - which is simply the inverse of the U-value ($U=1/R$ or $R=1/U$). So while a typical “high-end,” U.S.-made window might have U-values in the 0.30s or even 0.40s, actual high-performance windows will be less than 0.20. When we bought our Intus windows in 2013, we paid less for them than the best name-brand U.S. makers, and they provided more than twice the insulating protection - almost as much as a two-by-four fiberglass-insulated wall. The R-3 to R-4 we’re



Ground-breaking for the Intus “One Window, One Tree” program. Credit: Intus

used to finding for windows becomes R-8 to R-11 when you move upscale.

Low-e (low-emissivity) windows have a coating inside the outer pane of glass and, in triple-pane windows, inside the middle pane of glass in order to reflect heat back into the house. The cavities between glass layers can also be filled with inert gas (usually argon or krypton) to reduce conduction of heat through the window. The spacers at glass edge matter a lot, too.

Window frames are relatively thin but must have enough “beef” in them to support the window safely for decades, and perhaps to support opening, closing, slamming, etc. The construction of the frame is, therefore, additionally complicated when one attempts to make them super-insulating. Multiple small air channels throughout the frame provide strength while insulating; some are foam-filled.

Operable windows (sliding, double-hung, casement, awning, hopper, etc.) also risk air leakage around the moving contact surfaces, along with increased conduction through the hardware and the extra framing materials. Most European windows eschew the sliding and double-hung operations because of the severe engineering challenges presented, the additional expenses, and the resulting loss in performance. They mostly opt for “tilt-and-turn,” where the window can tilt inwards

from the top, or swing inwards like a door. Once one gets used to the change, the clear advantages regarding bad weather, bugs, breezes and cleaning can make one wonder why anyone would choose otherwise.

The glass itself can vary widely in its characteristics. Of course, tempered, tinted, millioned windows are available. The window’s solar heat gain coefficient (SHGC) describes how well it’ll let the sun through to help heat your home. We used the U-value and SHGC specifications to determine what performance characteristics we wanted for each outside wall of our house. North: fewer windows, low U-values, SHGC didn’t matter. East: we have a hill there so SHGC was unimportant, but low U was. West: western sun in the winter is pretty sketchy so, again, low U guided us. South: high SHGC was very important, more important than the U-value.

My message is paying attention to just the

two specifications briefly discussed above can guide you in the right direction. Low U-value for better insulating; high SHGC for solar gain. If you’re building or remodeling to the Passive House standard, all of these characteristics are automatically included in the modeling.

Barb and Greg Whitchurch are board members of Vermont Passive House and own a net-zero passive house with solar PV and hot water in Middlesex, Vermont. <http://bit.ly/2nRCdGL> (802)223-2416.



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Kingdom Bio Foam Fills the Need for Insulation

By George Harvey

Kingdom Bio Foam is a small insulating company in Vermont's Northeast Kingdom. Its story might best begin with an example of its work.

When Neil and Pamela McKiernan decided to build their retirement home, they knew exactly where they wanted it to be. They had spent many vacations at a summer home in Island Pond, Vermont, and that was where they wanted to live. Their new home is built on a property directly on the lake that gave the village its name.

Island Pond is a "census-designated place" in the municipality of Brighton. It had 810 residents, according to the census of 2010. Even so, it had about two-thirds of the people who lived in Brighton. Please understand that the whole of Essex County, the most northeastern of Vermont's counties, has barely over 6,300 people.

Island Pond is more active than census figures might suggest. Because of local winter activities which bring many visitors into the area, Island Pond has been called "the snow mobile hub of the Northeast." More to our immediate interests, however, is the fact that despite its size, it has some well-informed business people working in areas of plumbing, heating, and insulation. And so, when the McKiernans needed to find people to do those jobs on their new home, they were able to work with local companies.

The McKiernans have a large family, and they wanted a large home to accommodate them when they visited, regardless of the time of year. This meant that they needed both an efficient heating system and an efficient building. Neil McKiernan, who is knowledgeable about building construction, consulted with Darren Tardif of Tardif Plumbing and Mechanical on the heating and decided to install heating from two sources. One is a radiant system in the floor with the heat fueled with propane. The other is a pair of heat pumps in a custom-built system for heating and cooling.



The McKiernan's retirement home required insulation for an unusual roofing structure. Biofoam was the perfect solution. Images courtesy of Kingdom Bio Foam.

The insulation was installed by Kingdom Bio Foam. Owner, Coty Reeve, was trained by Spray Foam Distributors of New England and the Insulation Contractors Association of America in programs that look at best practices, energy code, and building code provisions for foam insulation. The courses emphasize R-values, vapor retarders, continuous air barriers, flame-spread index, smoke-development ratings, foam density, uses of spray-applied foam versus rigid foam, ignition barriers, thermal barriers, blower door testing, and municipal inspections. He keeps up to date on insulation practice by continuing regular training.

Kingdom Bio Foam's name represents the company's position supporting green building and sustainability. It is a family-owned business doing its part to reduce the nation's dependence on foreign energy, reduce its carbon footprint, and improve customers' indoor air quality by providing the most professional insulation services possible.

Nearly all of the foam sprayed by Kingdom Bio Foam is GacoOnePass Closed Cell Foam. This is a polyurethane foam with some surprising recommendations. It was subjected to the Air Barrier Association of America's material evaluation and received appropriate approvals. It was also awarded GREENGUARD and GREENGUARD Gold Certifications, which signify compliance with stringent chemical emissions guidelines.

The sprayed foam prevents air infiltrations, effectively preventing a set of

problems that can arise from pollutants, dust, pollen, moisture, and mold. Not only does this insulation prevent loss of heat, in many cases it also adds significantly to the rigidity of the building.

Site preparation started with isolating the work area, covering and masking electric boxes and outlets. Windows, doors, and anything else that is not to be insulated is similarly masked. Ventilation has to be set up, providing fresh air while the work is done. Only workers wearing proper protective gear are allowed into the site during the spraying process.

Once the spraying is complete, the window and door frames are sealed by installing a special foam to caulk and seal the cracks around them. Excess foam is scraped off and removed, masking tape and plastic films, and product containers are removed, and everything is made tidy.

At the McKiernan home, the insulation was installed in November, providing R-values of 28.8 in the basement and exterior walls and 50.4 in the ceiling. Once that was done, the propane radiant floor system could be run economically and construction work in the house could be finished in a fairly warm environment. The house was so efficiently weatherized that the radiant floor heat provided to the basement was enough to heat the entire building. At this writing, it is about 95% complete. The McKiernans hope to move in before summer.

Learn more: www.kingdombiofoam.com. 



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forces with Efficiency Vermont, the Weatherization Program, and other programs, to help navigate the complexities of funding as well as engineering and construction.

This program is aimed at serving lower-income households (meaning that it can only serve apartments that are "affordable" relative to average median income -- which includes most apartments in Vermont.) 3E

THERMAL serves all of Vermont. Find more details at 3EThermal.org, or call 802-477-5092.

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Is It Greener to Take Showers or Baths?

And How Can I Save Water Either Way?

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

As with most good questions, the answer depends. The main variables are how long the shower takes and the flow rate of the shower head. A typical bathtub holds 36 gallons of water, but most of us only fill it up partially. For baseline purposes, let's assume a typical bath uses 25 gallons. Meanwhile, a typical shower head does out 2.5 gallons per minute (GPM). (In 1992 the federal government mandated that all new shower heads sold in the U.S. had to be 2.5 GPM, although California, Colorado and New York have since instituted even lower limits for their own states.) According to this scenario, a 10-minute shower would use as much water as a 25-gallon bath.

If you can spend less than 10 minutes in the shower, all the better for the environment. Likewise, if you install a low-flow shower head—some models go as low as 1.5 GPM now—you can save even more water and money on your water bill. The U.S. Environmental Protection Agency's (EPA's) "WaterSense" label marks shower heads that are particularly miserly when it comes to water usage.

But just because a new shower head is low-flow doesn't mean it has to feel like it, given the genius of engineering going into new products from fixture makers. Delta may be leading the pack with its

"H₂Okinetic" design that uses larger water droplets to provide what it describes as "the feeling of more water without using more water." Its budget-oriented 75152 model (about \$30 online) can be toggled between 2.5 GPM and a stingy 1.8 GPM and is a top pick on leading review site Wirecutter. "On its 2.5 GPM setting, the Delta 75152 delivers a powerful, soaking spray through its four nozzles, which create a much denser spray pattern than the ring of spray holes found on most budget showerheads," reports Wirecutter.

Yet another way to cut down on water waste in the shower is by using a so-called "shower timer" that lets you know how long you've been scrubbing. Waterproof timers go from anywhere between \$6 and \$20 online; it might be the best investment in water conservation you could make. A more elaborate version is the \$149 Shower Manager, a battery-powered de-



Whether or not a shower or bath uses less water depends on various factors including how much you fill the tub, how long you spend in the shower and the "gallons per minute" rating of your shower head. Credit: Jon Rawlinson, FlickrCC.

mum. For starters, plug the drain before you start running the water and adjust the temperature as it fills up. Also, only fill up the tub to the minimal level you'll need to get your body wet and washed. And truly committed environmentalists can find a way to reuse the "gray-water" from the bathtub to irrigate your garden or water your houseplants, either by rigging up some kind of hose system or just with a plain old bucket.

Contacts: EPA Watersense Showerheads, www.epa.gov/watersense/showerheads; Delta's "H₂Okinetic" Design, www.deltafaucet.com/design-innovation/innovations/shower/h2okinetic-showers;

"Best Showerhead: Reviews by Wirecutter," thewirecutter.com/reviews/the-best-shower-head; Shower Manager, www.showermanager.com.

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A Teaser — Better Buildings by Design 2018 Hit the Target

By Barb and Greg Whitchurch

Better Buildings by Design (BBD), an annual conference held in Burlington and sponsored by Efficiency Vermont, covers residential and commercial building, sustainability, building systems and remote monitoring, lighting, heating and cooling, building standards, construction techniques, regulatory policy, green energy, the latest in building science, energy modeling, and so much more. Presenters and exhibitors come from all over the world. Attendees come from all over North America.

We both attended the keynote address by Dr. John Straub, and Adam Cohen's presentation on Integrated Project Delivery (IPD), but split up for most of the presentations, so as to cover the most ground.

One of the most fascinating and theoretical presentations was Adam Cohen's. Adam has a list of credentials, awards, and major "first!" accomplishments as long as your arm. His presentation was titled, "Changing an Industry by Changing Yourself." He began by talking about how successful he had become in his early construction career by building plain, "crappy" (your standard, run-of-the-mill) houses. During those years, he gradually became enlightened about climate change, and how the built environment contributes to it. In the United States, our built environment accounts for almost half of the greenhouse gases (GHGs) we release, and almost half of all the energy we use. It became obvious to him how he might help fight climate change. And he challenged us to think about how we might also contribute to the slowing of climate change.

He went on to state that, if we were going to survive the existential crisis presented by climate change, we must make big changes, and that we have no choice but to do so -- either the changes will be literally forced upon us, or we will anticipate that outcome and choose to act to moderate its effects.

He quoted Wolfgang Feist. "Investing in value instead of energy consumption requires little financial effort, but rather creativity and intelligent solutions." Dr. Feist is the cofounder of Passive House - the building standard that allows one to toss out the standard heating plant (furnace, boiler, heated floor) even in Fairbanks, Alaska. Passive House provides a complete planning tool that allows one to design their home and know - before ground is broken - just what the energy needs of the building will be. Adam devotes all of his considerable talents to Passive House projects and teaching now.

Adam pointed out that our brains are capable of finding solutions to the problems we're presenting here, but it takes some training. To support this statement, he quoted Albert Einstein: "We cannot solve our problems with the same thinking we used when we created them."

One example of a process to slow down climate change is the aforementioned IPD. Such a system leads to fiscal control, which can then make otherwise cost-prohibitive efforts palatable to the general public and funders. IPD provides a series of "locks" during the planning and implementation stages that prevent overruns and mistakes.

Commonly, member groups of a project team become "siloed." They operate within

their specialty (silo) and work on-site in a rather isolated fashion. Adam recognizes that de-siloing allows for a more coordinated, timely, and ultimately successful interaction among the providers. It allows them to communicate about their - often unspoken - expectations of one another; it obviates the conflicts and missteps that often occur when mismatching assumptions collide at the project; and it promotes consensual problem-solving of issues which are often mishandled when assigned to a single specialist.

Adam reminds us that Ban Ki-moon said, "Saving our planet, lifting people out of poverty, advancing economic growth ... these are one and the same fight. We must connect the dots among climate change, water scarcity, energy shortages,

global health, food security, and women's empowerment. Solutions for one problem must be solutions for all."

This short introduction does not do justice to Mr. Cohen's presentation or his idea, we're afraid. He is providing IPD trainings all over the world (<http://www.ipd.community/>).

The current issue of G.E.T. is so jam-packed that we can only present what's above. You can check out many of the presentation slideshows at <http://bit.do/BBD18-slides>. Stayed tuned...

Barb and Greg Whitchurch are board members of Vermont Passive House and owners of a net-zero passive house in Middlesex, Vermont. <http://bit.ly/2nRCdGL> (802) 223-2416.

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Lights Out for Residential Lighting Programs? Not Just Yet

Originally published at ACEEE.org
April 2018, Lights Out



LED light bulbs have transitioned from a fledgling technology to a major market player in recent years, with more than 450 million installed nationwide as of 2016. With Americans increasingly choosing LEDs, and federal standards set to increase efficiency levels for general service lamps (the most common type of screw-in light bulbs) in January 2020, many utilities and regulators are wondering whether it is time to leave residential lighting programs behind as they plan for the coming 2019–2021 program years.

Do the upcoming standards mean residential lighting programs will no longer be cost-effective? Or can programs gain another year or two of savings by promoting efficient light bulbs, which have long been the mainstay of residential program portfolios? These questions are at the forefront of utility program planning and regulatory agendas in many states. We find that for 2019, utility programs can achieve savings in most states by continuing to run programs for the full range of LED lamps. But the picture is more complicated for 2020 and 2021, and regional differences will also matter.

LEDs are gaining ground, but the race is not over

Overall, according to the National Electrical Manufacturers Association, LED lamps accounted for 36% of national light bulb sales in the fourth quarter of 2017, while halogen lamps still held 48% of market share. While the growth in LED market share is promising, these LEDs are largely displacing compact fluorescents (CFLs). The market share of halogens and conventional incandescent bulbs—both of which are much less efficient than LEDs and CFLs—has held steady, hovering close to 50% of sales since the end of 2014.

LED adoption varies across the states and even within the states depending largely on the presence of successful lighting programs and the mix of retailers. For example, state standards are accelerating the transition even further in California. The map below shows LED market share by census region and highlights the striking differences across the country. Many states still haven't reached 20%, while a small number of leading states have exceeded 40%.

Even in states where LED market share is already high (greater than 40%), continued investment in residential lighting programs is critical. Early evidence from New York and

Massachusetts suggests that LED adoption slows when program activity is scaled back, arguing for continued promotion rather than premature retreat. Targeted programs that address specialty products may be a good fit for these states. For others, there are still cost-effective opportunities for utilities—if not for a full three-year program cycle, at least for a portion of the cycle.

What a difference a year makes

For many states, 2019 looks very much like 2018 or 2017. New federal standards have yet to take effect and consumers continue to find a wide range of inefficient halogen and specialty incandescent lamps on store shelves. For 2020, the situation is much less clear. When the new standards come into effect on January 1, 2020 it will no longer be legal to sell most halogen and incandescent light bulbs, but there are several factors that could affect the initial implementation of the standard:

- **Legal uncertainty:** While there is still some legal uncertainty regarding implementation of the 2020 standard, ACEEE and others are fairly confident the new 45 lumens per watt (lpw) standard will go into effect.
- **Sales prohibition:** Unlike other federal standards, the federal backstop language triggering the lamp standard prohibits all sales of non-complying products as of the effective date. Virtually all other federal standards apply to the manufacture or import of products rather than sales, allowing for a transition period as retailers are allowed to sell their remaining stock of non-compliant products. This unique provision shifts enforcement to retail, creating uncertainty about the specifics and rigor of the enforcement process.
- **Product categories:** The original standards for general service lamps enacted in the Energy Independence and Security Act of 2007 (EISA), along with the 2020 backstop provision, covered the most common screw-based lamps. DOE has since expanded the definition and extended coverage to many lamps that were originally exempted from standards.

Rather than pre-determining the final fate of programs while the transition plays out, programs should take more of a “wait and see” approach. Program administrators should closely track market conditions in their territory and make final program decisions for 2020 in the fall of 2019, and hold off on final decisions for 2021 until the fall of 2020. By 2021, we expect that many of these transition issues will be resolved, and as the market shift to LEDs progresses throughout the country, it is likely that residential lighting programs will no longer be cost-effective beyond 2021. The residential lighting market will have transformed from an incumbent technology, largely unchanged for more than 100 years, to an entirely new technology with unprecedented speed—a major energy-efficiency success story.

Program opportunities

In the near-term, utility programs can achieve savings in most states by continuing to run LED promotions and incentives for the full range of LED lamps. There are also promising near- and

2015–2016 LED BULB SALES (AS A PERCENTAGE OF OTHER BULB TECHNOLOGIES SOLD)



mid-term opportunities for residential lighting programs, especially in states where LED sales are relatively high. Options include:

- **Underserved markets:** While national home improvement and hardware chains offer a robust mix of LED products and boast strong sales, a 2017 Consumer Federation of America study found smaller independent, grocery, and discount stores are less likely to stock and promote a range of LEDs. This is particularly true for those serving rural and lower-income urban neighborhoods. Programs can find additional savings by targeting rural, elderly, and low-income market segments that have been slower to adopt LEDs.
- **Specialty lamps:** Manufacturers have introduced LED versions of the most popular styles of specialty lamps including decorative, candleabra, globe, and reflector lamps, but market share for these lamps continues to significantly underperform general purpose LED lamps. High quality lamps: An increasing number of “value” LED lamps are hitting the market, but while they boast similar efficiency to ENERGY STAR®-qualified lamps, they are typically shorter-lived and do not meet the quality and performance criteria required for ENERGY STAR certification. Programs should consider continuing to

promote high performance ENERGY STAR branded products.

- **Controls:** Dimming and occupancy controls offer additional savings opportunities. Programs should consider promoting quality control solutions that are easy to install and operate to assure consumer acceptance and persistence.

Beyond lighting

While there is still some life left in residential lighting programs, most of these programs will end in a few years. Programs must turn their attention to new opportunities to expand and diversify their residential efficiency programs. ACEEE has identified a number of promising opportunities that can help fill the gap left by lighting programs. Smart technologies, including “smart” thermostats, offer a new area for energy savings. Other opportunities include advanced HVAC and water-heating technologies (including improved HVAC installation and maintenance), efficient and better-controlled plug loads, and more. Energy efficiency has a leading role to play in providing targeted, significant savings achieved at low cost, in a distributed-energy future.

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HOBART AND WILLIAM SMITH COLLEGES GO SOLAR

*Solar Installations to Provide Significant Amount of Electricity for Hobart and William Smith Colleges
Investment Complements "Finger Lakes Forward" – The Region's Comprehensive Strategy to Revitalize Communities and Grow the Economy*

By George Harvey

Hobart and William Smith Colleges are a singular institution in more than one respect. They are singular partly because they form together a single corporate entity, operating largely under a single administration. (This makes it hard, by the way, to tell whether singular or plural grammatical constructions are appropriate, so we beg pardon if things feel a bit strange in that respect.) Hobart is a men's college, and William Smith is for women, but they have a single campus on the shore of Lake Seneca, in New York's Finger Lakes, and they have a combined curriculum, with coeducational classes, since 1941. Men and women graduate together, but they get degrees from the two different colleges.

Hobart and William Smith Colleges are singular for another more recent reason. They now have one of the largest solar systems for any institution of higher education in the state of New York. Fittingly, perhaps, the five-megawatt system consists of two arrays of equal size. One array is in Geneva, New York, and the other is Seneca. Together, they will provide about 50% of the colleges' electricity. The colleges were recently listed as one of the fifty "greenest" in the country by The Princeton Review.



Professor of Economics and Chair of Entrepreneurial Studies, Tom Drennen (right), at Hobart and William Smith Colleges talks to students during a site visit to the Colleges' second solar farm. The installation features 7,800 panels on a 10-acre site in the Town of Seneca. Photo by Kevin Colton.

The announcement that the arrays had been completed was made by the colleges and the New York State Energy

Research and Development Authority (NYSERDA), which administers the project. Funding came under the state's billion-

dollar NY-Sun program, which leverages private investments. The systems were constructed during 2016 and 2017. Alicia Barton, NYSERDA President and CEO, made a statement on the new, combined system, explaining how it related to the other things New York had accomplished in the time from 2011 through 2017. She said, "This project continues New York State's momentum in supporting solar, building on Governor Cuomo's recent announcement that we have increased statewide solar power by more than 1,000 percent."

Hobart and William Smith Colleges' Vice President for Finance and Chief Financial Officer, Carolee White, provided some background for the colleges' decision to build the solar system. "These solar projects are part of Hobart and William Smith Colleges' work to reduce our carbon footprint and do what is right for the environment," she said. "Along the way, we hope to realize some financial savings, but our driving force has been to uphold and advance our commitment to environmental sustainability."

The two solar arrays were developed and installed by Dynamic Energy Solutions, LLC, of Wayne, Pennsylvania. Key Equipment Finance was a major funding provider.

Grass-Fed Beef Will Not Help Tackle Climate Change, Report Finds

By Daisy Dunne

Billed as a more environmentally friendly way to rear cattle, grass-fed beef has been the red meat of choice for many a climate-conscious carnivore.

Indeed, research has suggested that grazing cattle can help offset global warming by stimulating soil to take up more carbon from the atmosphere. This process, known as soil carbon sequestration, is one way of reducing the amount of human-induced greenhouse gases in the atmosphere.

However, a report released by the Food Climate Research Network at the University of Oxford found that cattle fed on grass release more greenhouse gas emissions than they are able to offset through soil carbon sequestration.

This means that grass-fed beef is "in no way a climate solution," said the lead author of the report.

Carbon from cattle

Livestock contribute to human-induced climate change by producing methane, a potent greenhouse gas. Cattle release methane through belching and passing wind, as well as in manure. Livestock also contribute to global warming indirectly through deforestation.

Overall, the livestock industry is responsible for around 15% of human-caused greenhouse gas emissions. Approximately 80% of these emissions come directly from ruminant animals, such as cattle.

The majority of the world's cattle are "grain-fed." In most cases, this means that the animals begin life grazing in the field, before being transferred

indoors to be fed on grains, such as corn and soy.

However, a growing number of livestock producers are choosing to feed their cattle on a diet purely of grass. These "grass-fed" animals spend the majority of their days outside, grazing.

Though feeding cattle in both ways contributes to global greenhouse gas emissions, it has previously been suggested that grass-fed cows could have a lower carbon footprint.

This could be because grazing cattle can stimulate plant growth, which in turn leads to higher levels of soil carbon sequestration, said Dr. Tara Garnett, lead author of the new report. "Animals help with [carbon sequestration] by nibbling away and chomping away, which stimulates the plants to grow. That can cause the plants to put down deep roots."

This process means that more organic carbon could become fixed in the soil, Garnett said.

Chewing the fat

To understand the impact of grazed cattle, researchers from the Food Climate Research Network spent two years analyzing the available scientific research on



Image: Kyle Spradley, Flickr

grass-fed livestock sector emissions, as well as its potential impacts on carbon sequestration.

The researchers reported that grass-fed beef contributes very little to

the global protein supply, accounting for just one gram of protein, per person, per day. In comparison, ruminants as a whole contribute 13 grams of protein to the global average protein intake, per person, per day.

The chart shows how different animals and crop contribute to the average daily protein intake.

Despite making only a marginal contribution to global protein intake, grazed beef accounts for between a quarter and a third of all greenhouse emissions from ruminant livestock, said Garnett:

"It's worth comparing (emissions to protein intake) because grazed beef have reasonably significant emissions when compared to the amount of protein that they provide."

The researchers also analyzed the total carbon sequestration potential of the world's grasslands. They reported that, if all of this grassland were grazed on by ruminants, 20 to 60% of the annual emissions of grass-feed could be offset by carbon

sequestration.

However, this estimate assumes that the environmental conditions are right for soil carbon sequestration to take place. Garnett added, "It's an optimistic estimate. The climate and the rainfall conditions needs to be right (for soil carbon sequestration to take place). If you overgraze the grassland, then you will get an annual loss of carbon from the soil."

Climate solution?

Despite the potential impacts of soil carbon sequestration, grass-feeding beef is overall a net contributor to carbon emissions and, therefore, a driver of human-caused global warming. Garnett said, "This report concludes that grass-fed livestock are not a climate solution. Grazing livestock are net contributors to the climate problem, as are all livestock. Rising animal production and consumption, whatever the farming system and animal type, is causing damaging greenhouse gas release and contributing to changes in land use."

The research suggests that the best way to tackle livestock emissions is to cut global levels of meat consumption. Garnett said, "Ultimately, if high-consuming individuals and countries want to do something positive for the climate, maintaining their current consumption levels but simply switching to grass-fed beef is not a solution. Eating less meat, of all types, is."

Reposted with permission from Carbon Brief, <https://www.carbonbrief.org/grass-fed-beef-will-not-help-tackle-climate-change>.

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.encyciencyVT.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

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

NH Office of Energy and Planning: www.nh.gov/oep/programs/energy/RenewableEnergyIncentives.htm

Renewable Energy World: www.renewableenergyworld.com

Renewable Energy Vermont: www.revermont.org

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

SmartPower: www.smartpower.org

Solar Components: www.solar-components.com

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

Solar Living Source Book: realgoods.com/solar-living-sourcebook

Solar Power Rocks: Impressive data and info ,including per state. www.solarpowerrocks.com/

Solar Store of Greenfield, MA Stock & install a wide variety of solar & environmentally friendly technologies. SolarStoreofGreenfield.com

Tax Incentives Assistance Project (TIAP): www.energytaxincentives.org

The Energy Grid: www.pvwatts.org

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

Track the Stimulus Money: www.recovery.gov/Pages/home.aspx

Vermont Energy and Climate Action Network (VECAN): works to start and support town energy committees as a powerful, people-powered response to realizing a clean energy future. www.vecan.net.

Vermont Tar Sands Action: Group working to stop the XL Pipeline and any other developments stemming from the Alberta Tar Sands. To join this group go to: groups.google.com/group/vt-tar-sands-action

VPIRG: understand the clean energy resources available to VT - www.vpirg.org/cleanenergyguide

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

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

www.susdesign.com Online info for solar benefit with house design: overhangs, sun angle & path...

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Please help us rebuild our activity center and farm facilities where we host sustainable farming, arts and natural building workshops for youth.¡Gracias! Learn more at bit.ly/Rebuild-Tobonuco.

China Moving Ahead on Solar Power

Last year, over half the solar panels installed in the world were put into Chines 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.

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Ingredient of the Month

THE NORTH HOLLOW DIET — AN ANSWER TO “MAGIC HOT BUTTON INGREDIENT” DIETS

By Larry Plesent

Did you ever notice how most diets (like cosmetics and supplements) are marketed around a “magic hot button ingredient”? Are you counting carbs? Avoiding sugars? Bulking up on meat? Do you take handfuls of pills for breakfast? Wake to the sound of juicing? Force yourself to eat foods you don't even like the taste of, then eat whatever you want anyway? If any of this sounds remotely like you, or you are simply as confused as the rest of us as to what to eat, read on! But first a little back story.

Growing up in the counterculture of mid 1970's Vermont, I have had extensive first-hand exposure to neurotic food fixations. In no particular order, I have tried being vegan (lost muscle mass), ovo-lacto vegetarian, fruitarian (lasted one day then the protein cravings won), “localvore” (only food from the New England Region) and omnivorous (eat the planet).

I once met a guy who claimed he lived on deep breathing and sunlight and only ate real food every four to five days. This sounded impressive until I found a bunch of Reese's Peanut Butter Cups and Almond Joy wrappers stuffed under his front seat.

I've been juiced, pill and powdered for decades. I once bought a kilogram of pure Vitamin C (thanks Linus Pauling) and took mega doses until I gave myself kidney stones. I took so many vitamins and minerals I had a factory direct wholesale account. I have fasted, cleansed, sweated, soaked and absorbed sunlight prana energy. And I am glad that I did. Because all of that led me to the North Hollow Diet, now revealed to YOU, the honored, informed and patient reader.



Image: dreamingabouteveryday.wordpress.com

The North Hollow Diet starts with facing the reality that our modern world is a chemical war zone.

We live in the age of petrochemicals and internal combustion machines. Every moment we exist, we are subjected to a never ending chemical assault. Our air, water, soil, food, clothing, personal care products, furniture coverings and water bottles all leach, ooze and off gas a plethora of unintended chemical hitch hikers which we absorb through our mouth, skin and lungs. There IS no escape from it even though we can reduce our overall exposure by choosing to live on the edge of civilization.

The obvious keys to survive and thrive this mess are to: a) avoid obvious points of chemical toxic exposure b) only eat nutritionally dense foods and c) to make changes one at a time and to do them for 21 days straight so they become a habit.

Fair enough? Are you willing to take the challenge? In each of the next several issues of Green Energy Times we will suggest one change to our diet and one change to reduce toxic chemical exposure.

Let's start with an easy one, your first tip to reduce your exposure:

Practice being aware of the exhaust that comes out of internal combustion engines.



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Pay attention to cars in particular, but also to generators, chainsaws and anything else that takes liquid fuel. Don't stand in car exhaust talking to your neighbor or let others do it around you. Pay attention to which direction the wind is blowing when warming up engines large and small.

Remember to wear gloves and some kind of eye protection when playing with petroleum fuels. If you do get a petroleum fuel (or soap) in your eyes, rinse it quickly with milk to stop the sting. Use castile soap to remove gas from your hands in case of accidental exposure. Gasoline is poisonous!

Remembering that the basis of our diet is to eliminate “fluff foods” and to only ingest nutritionally dense ones, we are going to begin the program by eliminating both sweetened and diet soft drinks from our life. If you do nothing else, this move could add years of healthier living to your time here on earth.

Let's go one step further and eliminate all liquids in clear flexible plastic containers, including personal size bottles of water. The clear flexi plastic is called PET or poly-ethyl-phthalate. This type of plastic off-gasses

chemicals that your body mistakes for estrogen. Male or female you don't want this, and it appears to make breast cancer cells reproduce 40 times faster in the lab.

“Milk jug plastic” or HDP2 has much less of this and is an acceptable alternative for your drinking water. Plus it costs a fraction of the price of the little bottled waters. The plastic rule is this: The clear and more flexible the plastic, and the stronger the plastic taste in the food or drink; the more plastic off-gassing you are getting. This effect is apparently strongest in water frozen in PET bottles and later defrosted.

Make your own fresh squeezed low sugar lemonade instead. Only use real lemons, which makes this into a super health food. Gradually wean yourself off sugary drinks by using less and less sweetener over time, until you use none at all. Make real, not powdered instant ice teas and iced herbal teas. Experiment and have fun with it!

There is a world of delicious tastes and foods out there and the best tasting ones are usually the healthy nutritious ones. Break out of your food comfort zone and take a cooking course. The North Hollow Diet is less about what you eat as it is replacing empty calories with nutritious ones.

Next issue we will continue with more of this county living style of eating and staying healthy. As has been said before and will be said again, “Common sense? Daaaarn Uncommon!”

This is the Soapman reminding you that Ramp Season (wild leek-like plants) is coming up fast! Harvest the tops and leave the roots. They will double year to year..

Larry Plesent is a writer, philosopher and soap maker living and working in the Green Mountains of Vermont. Learn more at www.vermontsoap.com www.reactivebody.org and www.cancereraser.org ♻️



Image: Pixabay

Why Should We Reduce Our Plastic Waste?



Image: pixabay.com

Because the Great Pacific Garbage Patch is Increasing Exponentially

A new survey published in *Nature* finds that the Great Pacific Garbage Patch is four to 16 times larger than previously thought, is composed of between 45,000 and 129,000 tons of plastic debris, and is “increasing exponentially” in size.

Read more about the evidence that the Great Pacific Garbage Patch is rapidly accumulating plastic at: <http://bit.ly/ocean-gyre-growing>. ♻️

AMUSEMENT PARK GOES SOLAR

Cont'd from p.1

the tallest and the second fastest roller-coaster in the world, reaching a height of 456 feet and top speeds of 128 mph (it was the fastest from 2005 until 2010, when it was surpassed by Formula Rossa at Ferrari World in Abu Dhabi). Most recently, the El Toro wooden rollercoaster won the 2017 Golden Ticket Award for World's Best Wooden Rollercoaster.

Conservation and environmentalism are also not new to Six Flags Great Adventure either, as they are the key focuses of its adjoining Wild Safari Park. According to the Six Flags website, the mission of Wild Safari Park is “to immerse our guests with an entertaining, fun and unique educational experience that will inspire all ages to conserve and protect our precious animal resources.” At Wild Safari Park, guests can go on an immersive open-air safari ride to see over 70 species of animals, including lions, giraffes and rhinos, as well as some species that are extinct in

the wild. Guests can also stop by the Camp Aventura area in the middle of the safari to visit newborn animals and to have an opportunity to feed giraffes.

It appears that Great Adventure's solar plans are the only significant sustainability news coming from the Six Flags parks' in the northeast and beyond.

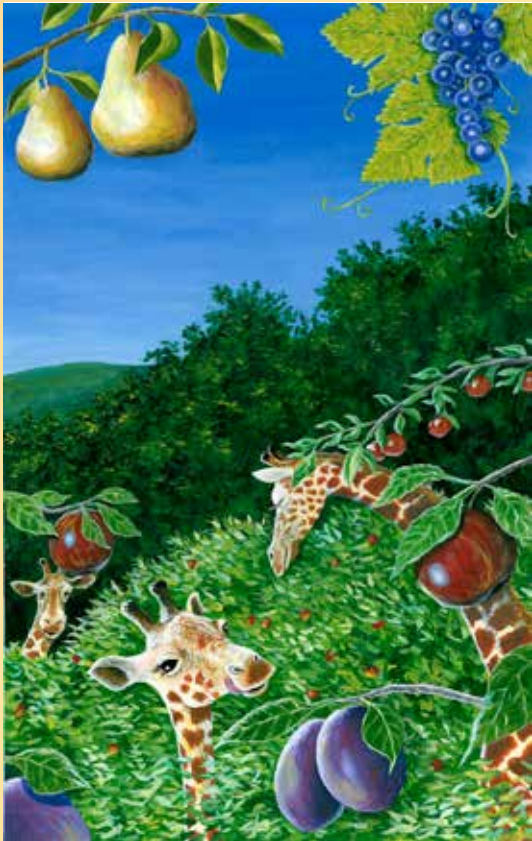
Winkler himself suggests that the 23.5MW solar development may only be the beginning of Six Flags Great Adventure's utilization of solar and other forms of renewable energy, saying, “Clean energy is right for the environment and our future, and we look forward to decades of environmental stewardship with KDC Solar.”

Although Superman, Wonder Woman and the other members of the Justice League who are often seen at Six Flags parks could not be reached for comment, we suspect that they would be quite proud of Great Adventure and KDC Solar for doing their part to save the world.

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

ELMORE ROOTS' PERMACULTURE KNOW-HOW The Original Sustainable Agriculture and Forestry Project

by David Fried



Painting by Gabriel Tempesta

Somewhere, on the plains of Africa, there are giraffes with long tongues reaching into the trees for food. For thousands of years there has been enough. They move freely between groves and down below, smaller animals find what they need, too — down to the beetles and the fungi.

When I was nineteen, I hitchhiked across West Africa. The villagers in Upper Volta made fires at night and beat on drums to keep the lions away from their village. In the very early morning mist, we saw a baby elephant holding onto its mother's tail and walking across the forest. I had the notion that they wanted us to come closer, to touch them. But as soon as we took a few steps in their direction, they stomped and uprooted trees and threw them towards us.

Here at Elmore in northern Vermont, we put up a deer fence to protect our young fruit trees from deer and moose.

Since they were used to walking across these fields, there were skid marks and moose head shapes in and around the fence soon after we put it up. In spring, there was a layer of moose droppings all along the outside of the fence, where they had been checking to see if they could get in somewhere. For years, the deer and moose have picked up the dropped fruit and nibble on the branch tips. In return, we get the organic fertilizer and get to live in a world that still has wild life.

For us at the farm and nursery, sustainability means living with other forms of life. The birds sometimes eat or peck into pears, but they also eat the insects that would make the pears unattractive. The meadow voles sometimes chew some roots or stems or vegetables, but in the process, we get our clay soils aerated.

We grow many kinds of fruit, so that if it is a poor year for apples, it will be a bountiful year for grapes or plums. We put up our fence in two parts, so the deer can have their ancestral route along the stream in the middle. We have fenced

ourselves out of their stomping zone.

What is it that the giraffes, the elephants, the deer, the moose, the birds, the voles and, hopefully, some of us humans have learned, probably without realizing it? There is a rich fabric of life and wonder all around us that has nourished and fed us for a long, long time. Let's have the eyes to see the harmony around us and keep the land and our beings nourished. We can reach into the trees with our long necks and drink deeply from the nectar of the universe.

David Fried is the grower/poet of Elmore Roots fruit tree nursery in Elmore, Vermont. ♻️

Monadnock Region EARTH FESTIVAL Celebrate Community and the Planet

KEENE, NH - Monadnock Food Co-op presents the Monadnock Region Earth Festival on April 21, 2018, from noon to 4:00 pm (rain date of April 22). This free public event takes place outdoors around the Co-op and along the bike path, leading to the Railroad Square Park in Keene.

This year's event will be the biggest so far, offering the community an opportunity to connect directly with over 70 local organizations, farmers, and artisans during the festival. There's something for everyone, young or old, novice or avid environmentalist. The Keene Music Festival will be sponsoring live music in the amphitheater throughout the event and activities, and games will be hosted by many organizations.

Shop The Farmers' Market of Keene in the lot next to the Co-op; Beadin' in Eden, Lone Wolf Cheese, Deer Ridge Farm, Archway Farm, Woodard's Sugar House, Little Greens, and many more! In addition, there will be a vendor fair inside the Co-op featuring samples from other local and sustainable producers.

The Monadnock Progressive Alliance will be launching their "Ready for 100% Renewable Energy" campaign with the support of the Sierra Club and many other local partners. This announcement will take place at the amphitheater behind the Co-op from 1:00 to 1:20 pm.

The Co-op will host a Local Food BBQ on their cafe patio during the festival. Featuring a farm-to-fork meal for only ten dollars. House-made side dishes and desserts will also be available for purchase in addition to the full hot bar menu, sandwiches, and smoothies inside the Monadnock Food Co-op.

The one-and-only Caterpillar Lab will be on hand, blending art, science, environmental education and their love of caterpillars! Inside the Co-op, customers will have the opportunity to round up their change to the next dollar - or five - for the Caterpillar Lab, a local non-profit.

Visit www.monadnockfood.coop/earthfestival for more information.

The Monadnock Region Earth Festival is sponsored by the Monadnock Food Co-op. ♻️



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Product Preview: LEDdynamics™ Gro-Lights

— Just in Time for Gardening 2018

By George Harvey & N. R. Mallery



Children amazed on how LEDdynamics™ EverGrōT8® work during a makers fair in 2017. Courtesy photo.

Ever since we first heard of LEDdynamics, Inc.'s™ EverLED® lights, which are drop-in replacements for four foot lights in many fluorescent fixtures, we have been waiting for them to offer a grow light. LEDs have a number of important advantages over fluorescent lights, including reduced energy consumption, better light quality, absence of toxic mercury and UV, and longer life, which leads to being safer and the need for replacement is significantly reduced. When we first inquired about the emerging LED horticultural technology, we learned of the challenges of producing a new cost-effective product, so we waited patiently. As a growing engineering and LED lighting manufacturer in Randolph, Vermont, LEDdynamics™ is known for their innovation.

Our wait has finally paid off. LEDdynamics™ has introduced the EverGrōT8®. "The spectrum of light emitted by LEDs can now be tailored to maximize Photosyn-

thetically Active Radiation (PAR), the major driver in plant growth. Our goal was to give residential and small scale growers cost effective access to this exciting technology. Now folks can simply plug our EverGrōT8® tubes into inexpensive T8 (instant start) fluorescent fixtures," said Bob Sparadeo, Director of Sales. This means that T8 fluorescent fixtures many people have around may find new life as relatively low-cost grow lights. At roughly \$39 each, they may seem a little expensive at first, but they can reasonably be expected to pay for themselves in the reduced energy bills and less frequent replacement. Add to that the already-mentioned environmental advantages, and they are clearly winners.

Because the lights reduce electric usage by 40%, they also give off 40% less heat. This can be important when HVAC is being used. They can be dimmed. They are normally mounted six inches or a little more

from the plant leaves. For those gardeners who happen to also be into the physics of light, their photosynthetic photon flux is over two μmol per second, per watt. They have a five year warranty.

Given the savings they can deliver, the EverGrōT8® should be interesting to anyone using artificial lights to grow plants. They should be great for those of us with small gardens, who start seeds indoors in the winter for spring planting outdoors. They can save a lot of money for professional growers who depend on lighting in the winter. Vertical farming is growing quickly, with many restaurants and supermarkets using indoor spaces year round to grow leafy crops, so they can be as fresh as possible when the customer buys them.

Green Energy Times editor Nancy Rae Mallery has been testing the LEDdynamics™ EverGrōT8® lights. She had this to say, "I use organic gardening practices and being able to get a head start on the growing season adds to my own sustainability. LED grow lights keep my environmental footprint low. Though it is still early spring, and the plants my neighbor and I sprouted from seeds could not get very big before we had to go to press, I am impressed with the EverGrōT8® lights. I want to let our readers know about this great product now, since it's time to start those seeds. Believe it or not, gardening season is just ahead of us. These grow lights can provide us with one more way to make gardening and agriculture more sustainable."

Mallery adds, "Part of the reason I hope gardeners will consider using EverGrōT8® lights is that they are locally made. We should support local economies by using

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What is Sustainable Furniture & Flooring, Anyway?

By Susan Inglis

When people first hear of our organization, they often ask, "What is sustainable furniture, anyway?" I usually explain that there are many different possible answers to the question, and I am happy to take as much time as they have in elaborating! But time is precious. In a nutshell, it is likely that whatever pops into your head as a possible answer is right. Sustainability is an umbrella term, and it is a wide umbrella, with many different issues coming under it, many of them related: global warming, deforestation, extinction of species, toxic waste pollution, poor indoor air quality, water pollution, overcrowding of landfills, exploitation of workers, exploitation of indigenous people, care for local economies, etc.

The furniture industry relates directly to many of these issues. It is a global manufacturing industry, so uses a lot of electricity and has a large transportation footprint causing a lot of carbon dioxide pollution. It is also one of the largest consumers of wood and actually provides the most in added value to the raw material. Practically all furnishings products have a finish, so frequently arrive at the consumers' home emitting volatile organic compounds, or VOCs, that pollute our indoor environments, causing particular problems for people who suffer from respiratory diseases. And practically all furnishings arrive packaged, which leads to a great deal of packaging waste.

Sustainable Furnishings Council (SFC) is

helping the industry address these and other problems so as to reduce the environmental footprint, encouraging suppliers, manufacturers, retailers and design firms to make choices that will sustain a healthy future. The choices consumers make are also very significant, in their own homes and with implications for the future. To be helpful, SFC provides a "finder" at sustainablefurnishings.org and also offers a variety of resources to guide consumers in making choices to address specific issues.

Here is an overview of some of the choices you might consider the next time you go shopping for furnishings, starting with simple questions about what it is made of and where it comes from.

Buy as locally as possible.

Domestic manufacture not only ensures a smaller transportation footprint and so reduced CO2 emissions, but also remember, we have pretty good laws for controlling other air and water pollution, and for workers' rights, and pretty good compliance. In addition, of course, you are supporting your local economy.

Learn where the wood comes from.

If your furniture and flooring is made in North America of North American wood, you can feel less concerned about it. Certification of the source is important, especially when the wood is not North American. Forest Stewardship Council certification, for instance,

provides excellent assurance that the wood comes from well-managed forests, and that the people involved in managing the forest, harvesting the wood, and milling the lumber are treated fairly. It is also assurance that the wood was grown and harvested without harmful chemical inputs. Caring for our forests is especially important because we all depend on them to absorb carbon dioxide emissions and filter water, as well as for the wood used in making that fine furniture and flooring. A shopping guide to find FSC-approved retailers, products, and brands can be found at <http://bit.ly/FSC-ShoppingGuide>. A builders guides to find FSC-certified wood suppliers is at <https://advocate.us.fsc.org/construction>.

Avoid harmful chemicals.

Furniture is complex! It is often made of many different materials, in many different processes. Some of the harmful chemicals used in production may still be present when the furniture comes home with you. Asking will help you avoid a few chemicals that may be particularly harmful. The most common in furnishings are VOC's in the finishes and adhesives; flame retardant chemicals in the foam and the fabric; fluorinated stain treatments on the fabric; anti-microbials in the mattresses; and PVC or vinyl in faux leather or fabric. Asking questions is important for getting to the bottom of "What's it made of?" but there are certifications you can look for, such as GreenGuard, which ensures low or no VOC's.

Choose natural fibers.

Natural fabrics often require fewer chemical inputs in production than synthetic fabrics, and many natural fiber fabrics are inherently fire resistant. Fabrics that are made of organically grown fibers are a good choice, because organic cultivation saves the use of large quantities of toxic inputs from fertilizers, herbicides, pesticides, etc. Low-impact dyes reduce the environmental impact of leather and fabric production. OekoTex and GOTS certifications are effective assurance that a fabric has been produced without toxic waste pollution.

Shop SFC Member Companies.

Establishing credible, meaningful standards and being vigilant in continually improving them remains the primary goal of Sustainable Furnishings Council. The organization is recognized by the EPA for providing a credible eco-label for furniture, so you can look for Silver or Gold Exemplary tags as you shop.

But since sustainability is such a wide umbrella, we know that you will be shopping with your own priorities. Since sticking to the budget is a priority for most of us, I want to conclude by assuring you that many best choices for sustainability do not add to cost.

Shop SFC Members in Vermont such as Copeland Furniture (156 Industrial Drive, Bradford, VT) and Burlington Furniture (747 Pine St., Burlington, VT).

Susan Inglis is the Executive Director of the Sustainable Furnishings Council. ☸



Image: Wikipedia



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Every FSC-certified product you buy - from lumber to furniture, and from paper to tissue - helps promote responsible forest management. Image: FSC US

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WASTE IS A DESIGN FLAW

By Jonny Finity

As a species, we often take for granted our superiority to the rest of the animal kingdom. We point to the great cities we have built; the mechanical systems that we have engineered; the enormous problems our magnificent brains have enabled us to solve. And yet...

Reminders of humanity's success are easy to spot. The failures are harder to see, because – well, because we don't want to see them. We spend a lot of time and money hiding the unwanted side effects of our "success." "Not in my backyard," we say. We build a wall around them; we bury them in a distant landfill; we throw them away.

I recently spent a week visiting Tulum, Mexico, a small beach town on the Caribbean Sea. It's famous for its ancient Mayan temples, crystalline underground pools, and long, uninterrupted stretches of white sand and turquoise waters. And at one point, at least, all of that was probably true.

Today, the beaches (at least, the ones not swept daily by resort staff) are littered in a near never-ending stream of human-made debris. Plastic bottles, glass bottles, Styrofoam blocks, unmatched flip-flops -- all discards from cruise ships, Caribbean islands, or who knows where.

A colleague used an expression recently that stuck with me, "Waste is a design flaw." When we realize that we've built a world of cities that can't live without landfills, do we consider drafting a new design? Or do we look for space to build more landfills?

Visiting the remains of ancient civilization makes me acutely aware of the legacy that we modern humans are collectively creating for ourselves. I think about the archaeologists born five hundred years from today who make careers out of studying us, and the things we left behind.

I wonder, will the Mary Leakey of tomorrow rejoice when she unearths a "modern" landfill, excited by the discovery of an airless tomb of vacuum-sealed secrets? Or will she sigh, resigned to a future spent scraping up potato chip bags and packing peanuts?

Landfills are, in effect, a time capsule of our flaws. They are giant trophy cases filled with tributes to failed designs.

Fortunately, we ARE humans. You know: builders of great cities, engineers of powerful machines, owners of magnificent brains. Maybe we'll emerge from that drafting room with a plan to create

products and packaging designed to be entirely recycled, reused, consumed, or composted. Or maybe we'll be the stars of a case study in design failure from a textbook written for the next generation.

Jonny Finity is the Marketing and Communications Manager for Chittenden Solid Waste District (CSWD).



Coventry landfill filled with "design flaws." Courtesy photo.

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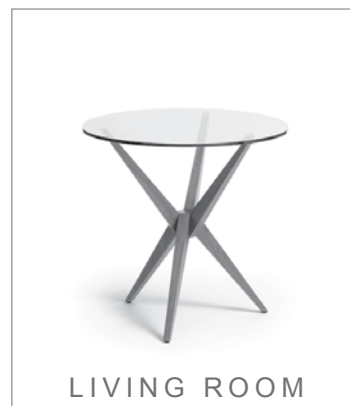
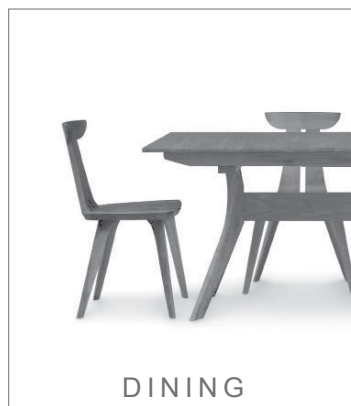
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