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## Keeping a natural product natural with renewable energy and more

By George Harvey

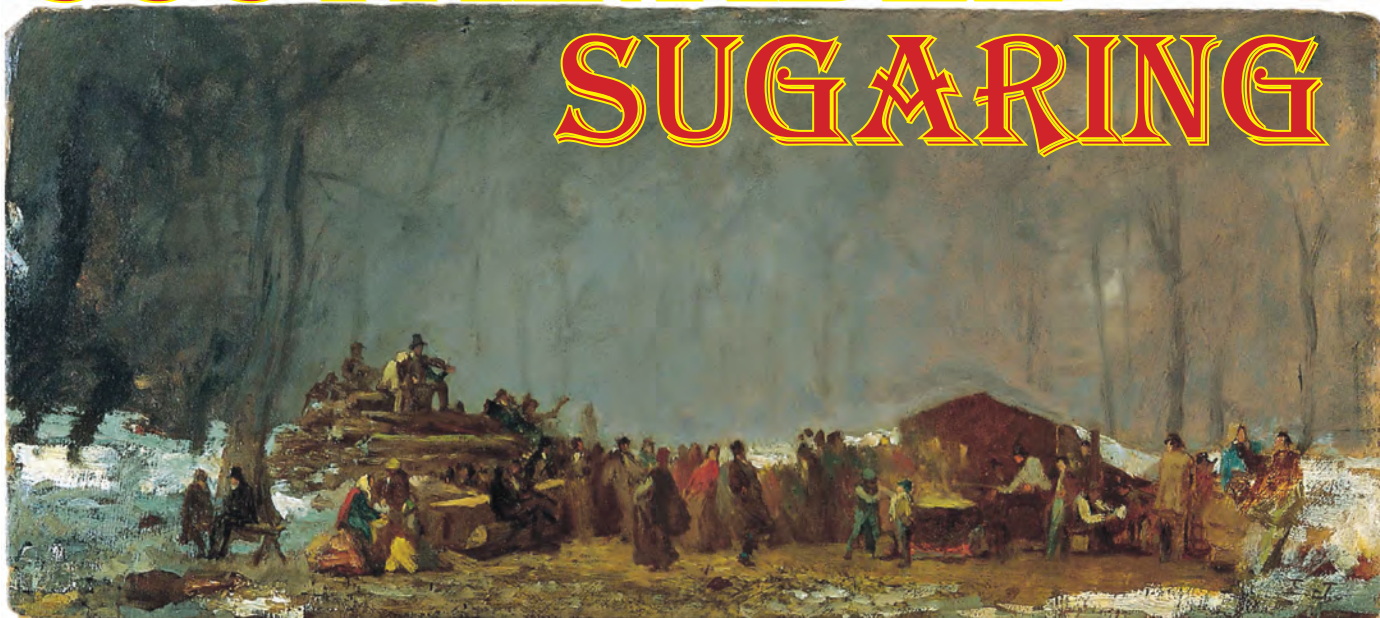
Old-time pictures of traditional maple sugaring are deeply ingrained in the minds of many of us, and not just those of us who grew up long ago in Vermont or New Hampshire. Covered buckets hanging from taps on trees, people trudging through the snow with buckets of sap, horse-drawn sledges with tanks, and open-air evaporators are all part of scenes many of us easily remember, even if they are from before our times. We know them from quaint photographs and paintings by such illustrators as Norman Rockwell, Grandma Moses, and Currier and Ives.

In those days, the work for the next year's harvest started with cutting many cords of firewood to boil sap. It was an energy intensive operation, both in terms of human labor and in the quantity of wood. In the days before trucks and chainsaws, maple sugaring might have produced quaint pictures and fond memories, but it was not easy.

Through the years, maple-sugaring operations turned progressively toward methods that reduce labor. Oil has been used for fuel and gas-powered engines do much of the work.

Recently, however, standards have updated again. The predictable maple sugar producer's love of the land has started to transform the industry to practices chosen for sustainability and low pollution. Today,

# SUSTAINABLE SUGARING



*The Maple Sugaring Camp," ca. 1870, by Eastman Johnson. In the 19th century, sugaring could be a community thing, with musicians sitting on the woodpile, and dancing near the fire. Public domain.*

some local operators have turned the corner, giving up on fossil fuels almost entirely, making them nearly 100% dependent on renewable resources.

Some maple sugaring operations have gone back to wood to fuel evaporators. But boiling sap is not the only process on

the farm that takes a lot of power. Buildings need to be heated and powered with electricity, and vehicles need to be fueled. Turning from grid-powered electricity to solar is an obvious step. So is heating buildings without fossil fuels, and even going to bio-diesel for vehicles.

We were surprised to discover there is a lot being done in other areas we did not think of right off. A look at a few of the maple sugaring operations in Vermont and New Hampshire provides some great examples.

*Feature continued on page 20*

## KINGDOM COMMUNITY WIND SHOWS ITS VALUE

By George Harvey

During this winter's cold snaps, as the grid power system struggled and wholesale prices went as high as 60¢/kWh, the turbines at Kingdom Community Wind kept on turning out inexpensive power for Vermonters. The wind farm, which began generating power in November or 2012, has 21 turbines rated at 3 MW each. They produce 186,000 MWh per year, sufficient power for 24,000 homes.

Kingdom Community Wind produces more than just electricity. Green Mountain Power is committed to sharing some of the economic benefit from the wind farm with local communities through a Good Neighbor Fund. The fund provided a total of \$126,000 to five local communities, Albany, Eden, Craftsbury, Westfield, and Irasburg, all of which



*Kingston Community Wind, photo courtesy of Green Mountain Power*

are within five miles of the site. The fund will be distributed each year for the first ten years of the wind farm's operations.

Other news on Kingdom Community Wind includes results of testing for sound. As part of comprehensive, ongoing sound

*Cont. on page 15*

## SOLAR IS NOT TOO EXPENSIVE - SOLAR COSTS LESS THAN YOUR ELECTRIC BILL!

GET staff article

Solar PV has never cost less!

Solar module prices continue their free fall, largely driven by global market fundamentals - high installed capacity, Chinese government subsidies on their domestic manufacturing, and global recessionary pressures.

Top-of-the-line modules, which were at \$2.25/watt as recently as in 2010, are now closer to \$0.75/watt! Consequently, total installed price for roof-mount PV is in the \$3-\$4/watt range, and about a \$1/watt more for ground/pole mount PV. It is not necessary to have a prime site for installation either, because it is possible to buy membership in solar cooperatives for \$4/watt.

Checking with local installers proves the point. We got this from Power Guru in North Bennington, Vermont: "Roof-mount grid-tied PV is now as low as \$3.50/watt for systems in the 3-5kW size range and \$3/watt for larger systems. Lifetime Cost of Electricity with PV is now in the \$0.12-\$0.15/kWh range, even before incentives



- i.e. grid parity is now a reality!"

What does this mean for you?

As a rough rule of thumb for solar PV output in the Northeast, 1kW of solar (4 modules of roughly 3'x5' each) generates 1,000kWh of electricity per year. Since modules are warranted for 25 years, over their warranted lifetime they would produce 25,000 kWh at a total upfront cost of \$3,500 or less, before incentives

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## VIEW FROM THE TOP



# Picking Up the Pace to Reach 20% Renewables by 2020 – Part Two

Vermont's current statewide comprehensive energy plan calls for 90% of our

total energy to come from renewable energy sources by the year 2050. At the Renewable Energy Vermont conference in Burlington last October, REV leadership publicly announced the need for immediate progress toward the next step along that path: a more modest goal of 20% renewable energy by 2020\*. (Remember that our statewide figure for total energy use includes all electricity and fuels, including those used for heating and transportation.) In my last column, I outlined the specific roles that energy efficiency, conservation and solar energy would need to play over the next seven years for Vermont to meet its 2020 energy goals. Those three areas alone would enable us to realize 74% of our 2020 target amount. Here, I'd like to look at developing other systems and resources over the next half-decade to account for the remaining 26% of energy required to fully meet the

2020 goals. That smaller share breaks down to wind energy at 15%, biofuels at 10%, and in-state hydropower at 1%.

Wind Energy. We will need to build another 225 MW or 68 MW average\*\* of wind energy capacity. To date, we have about 120 MW (36 MWavg) of wind power capacity installed in Vermont. Four wind farms are currently operating across the state: Searsburg (6MW, commissioned in 1997), Sheffield (40 MW, 2012), Lowell (63 MW, 2012) and Georgia (10 MW, 2012), along with approximately 1 MW of small wind turbines at homes, schools and businesses. Out-of-state wind energy has been purchased by Green Mountain Power (54 MW), and the Burlington Electric Dept. is contracting for about 13 MW. Assuming that our Vermont utilities may contract for another 38 MW of out-of-state wind energy, we will need to permit and build another 120 MW of wind in VT by 2020. That is an amount equal to the 120 MW we built over the last 20 years. There are wind projects currently in the measurement and permitting phases (Seneca, Grafton, Deerfield) that could fulfill the majority of this 120 MW goal. Additionally, multiple smaller five-to-ten MW community-scale

wind farms could be built. These local projects could leverage local ownership and financing, and potentially use group net metering to allow Vermonters near the turbines to benefit directly from the fixed-price electricity. (This is common in Denmark and other Scandinavian countries that have pioneered successful and economically equitable community-scale wind.) We need to expand net metering up to at least 5 MW for renewables, so that local people can buy electricity produced via local wind energy.

Biofuels. Most of the biofuels we will be able to harvest sustainably in Vermont will come from biomass, mainly wood. To get to 45 MWavg of energy from biofuels, we will increase the use of wood pellets and wood chips. In order to meet our efficiency goals, any electricity from biomass will need to come from combined-heat-and-power district heating systems, where waste heat from burning fuels for electricity is captured to heat a town or neighborhood. Other biofuels such as biodiesel will be small contributors to our heating and transportation needs. I am not a big supporter of burning stuff or trying to use

Cont. on page 24

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## VERMONT'S TOTAL ENERGY STUDY: A ROADMAP TO A CLEAN ENERGY FUTURE

By Johanna Miller

Vermont has established clean energy and climate goals that anticipate the inevitable shift away from fossil fuels and the imperative to confront climate change, including a 20-year Comprehensive Energy Plan that set a goal of meeting 90 percent of Vermont's energy needs by 2050 with renewable supplies.

But Vermont has a long road ahead to reach its goals. Only about 16 percent of the state's energy portfolio today is renewable. How to make the transition to a clean, renewable energy future is not yet clear.

The state's "Total Energy Study" being crafted at the Public Service Department aims to provide the necessary roadmap. The study is considering all our energy needs — heating, transportation and electric power — and is intended to serve as a "how-to" blueprint, pointing us in the best direction for meeting our energy and climate goals.

In December, the PSD released an interim report outlining five potential policy pathways and a mix of energy technologies and approaches that Vermont might embrace.

The policy pathways under consid-

eration include requiring providers of energy to meet a fraction of their sales with renewable energy or efficiency, as well as a nearly revenue-neutral carbon tax shift.

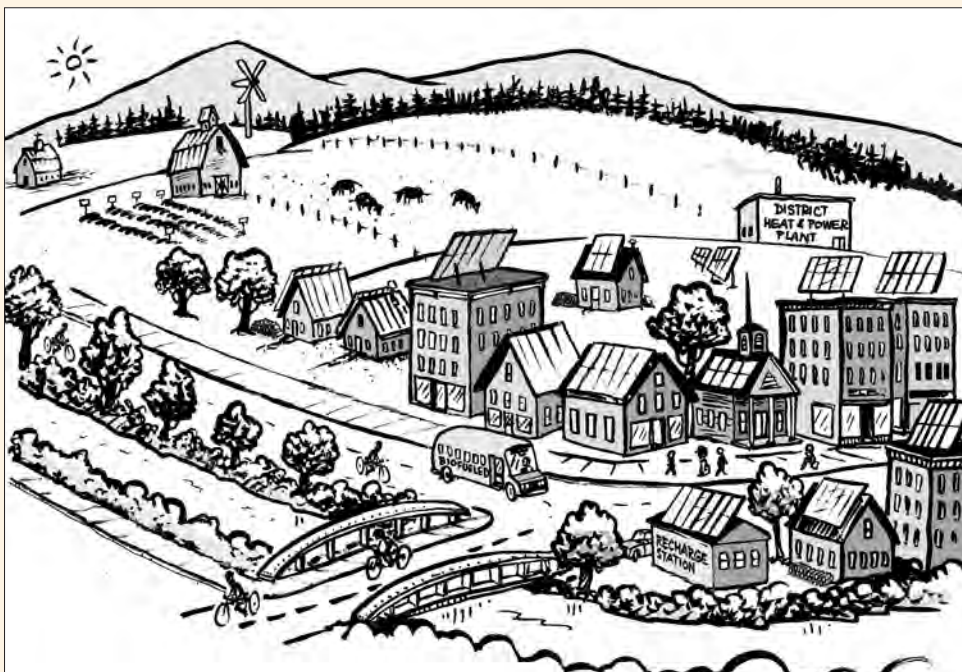
The report also analyzes the potential mix of technologies and approaches that could work best. Should Vermont focus on more local, diversified, distributed generation, or solutions with greater economies of scale? Should biomass and biofuels play a dominant role in our energy supply or will electrification play a far bigger role in meeting energy needs across sectors? What kinds of land-use strategies will be required to foster compact, walkable communities?

These are big questions with no concrete answers yet — or probably anytime soon.

"It's a process intended to help set us on a path," explains Asa Hopkins, the director of energy policy and planning at the Public Service Department. "We know that the first thing we have to do is drive demand down as much as possible. From there, we can ask how to meet the remaining demand in the right way."

"Vermont, the United States and the world have to realize a new energy future based on clean, affordable and secure forms of energy," said Andrea Colnes, executive director of the Energy Action Network.

"The Total Energy Study provides two important opportunities," noted Colnes. "One is to think about energy from an integrated perspective versus a 'siloed,' piecemeal approach. The other is that it gives Vermonters a valuable platform



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to work together to craft a sustainable energy future instead of having it come at us in an unplanned, divisive way."

The five potential policy pathways and technologies outlined in the interim report will be whittled even further, based on public comment and further Department review, to three policy priorities which will undergo a quantitative analysis. Those findings will be released in a final draft of the Total Energy Study, expected this summer. From there, its anticipated and hoped the study's results will inform the next Comprehensive Energy Plan and needed policy making.

"The era of cheap, easy energy is over. The conventional fossil fuels upon which we've built the world's economies are harder to reach, increasingly expensive and wreaking havoc on our planet," said Vermont Natural Resources Executive Director Brian Shupe. "Broad-based solutions like those the total energy study is exploring are necessary for planetary and economic stability. This process is really important."

Johanna Miller is energy program director at the Vermont Natural Resources Council — jmillervnrc.org.

Check out the PSD's report — [http://www.publicservice.vermont.gov/publications/total\\_energy\\_study](http://www.publicservice.vermont.gov/publications/total_energy_study)



# ALL ABOARD! RAIL IN VERMONT

## VRANS Highlights and Accomplishments

By Christopher Parker

Vermont Rail Action Network attends meetings at the state house and with the Agency of Transportation. We engage the railroads and Amtrak. We show up around the state, engaging the public. We even went to Washington DC, advocating for better trains in Vermont. Here is a sampling of what has been and is being accomplished:

### In-state Amtrak fair

The popular \$12 in-state Amtrak fare will continue in 2014 with a new fare code: V657. The Amtrak website has recently changed, making it harder to book this fare online. You can call 1-800-USA-RAIL, but you must ask specifically for the discount. Reservations must be purchased at least one day prior to travel. The fare is

not available on certain peak travel days and has limited availability, so do book as far ahead of time as you can.

### TIGER Grant

Vermont succeeded in receiving a federal TIGER program grant for the Western Corridor. When the work is done only 12 miles of rail will remain to be redone between Rutland and Burlington, as well as some bridge and crossing work. The upgrade will enable competitive speeds for a planned extension of the Amtrak Ethan Allen north to Burlington by 2017.

VRAN has made investing in the Western Corridor a priority and continued to advance it with the Agency of Transportation, the Governor and in Washington DC.

### Bikes on Trains

VRAN has been actively advocating for

Cont. on page 5



44% of greenhouse gasses in Vermont are produced by transportation. If you want to support the environment, transportation is the next place to look. Photo courtesy of VRANS.

# SMART COMMUTING IN NH & VT

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

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

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

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

When carpooling, remember to use the local Park n Ride lots to meet your connections. Start your trip planning at [connectingcommuters.org](http://connectingcommuters.org) or [nh.gov/dot/programs/rideshare/](http://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](http://uppervalleyrideshare.com).

**ADVANCE TRANSIT (AT)** - Free weekday bus for Lebanon, Hanover, Enfield, Canaan, NH, and Norwich and Hartford, VT. Dartmouth and DHMC Shuttles. ADA Services. 802-295-1824. [advancetransit.com](http://advancetransit.com) CARROLL COUNTY TRANSIT - Services and connections to Belknap County. 888-997-2020 [tccap.org/nct.htm](http://tccap.org/nct.htm)

**CITY EXPRESS** - Serves Keene. 603-352-8494 [hcsservices.org/services/transportation/cityExpress.php](http://hcsservices.org/services/transportation/cityExpress.php)

**COMMUNITY ALLIANCE TRANSPORTATION** - Services for Claremont & Newport. 603-863-0003

**CONCORD AREA TRANSIT (CAT)** - Serves Concord 603-225-1989 [concordareatransit.org](http://concordareatransit.org)

**CONTOOCOOK VALLEY TRANSPORTATION (CVTC)** - Monadnock Rideshare for the southwest region 877-428-2882 [cvtc-nh.org](http://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](http://cart-rides.org)

**DARTMOUTH COACH** - Services to Boston, Logan Airport and NYC 800-637-0123 [dartmouthcoach.com](http://dartmouthcoach.com)

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

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

**WINNIPESAUKEE TRANSIT SYSTEM (WTS)** - Services Belmont, Franklin, Tilton, Laconia. 603-528-2496 [bm-cap.org/wts.htm](http://bm-cap.org/wts.htm)

## 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](http://vitalcommunities.org/transport/index.htm)

**VERMONT PUBLIC TRANSPORTATION PUBLIC TRANSIT** - Lists transit, ferries and more at [aot.state.vt.us/PublicTransit/providers.htm](http://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](http://amtrak.com)

**CHITTENDEN COUNTY TRANSPORTATION AUTHORITY** - Burlington bus service with links to Montpelier, Middlebury and commuter route to Milton. [cctaride.org](http://cctaride.org)

**CONNECTICUT RIVER TRANSIT** - Services in Bellows Falls and Springfield. [crtransit.org](http://crtransit.org)

**GO VERMONT** - Offers carpool matching and commuter connections in VT 800-685-7433 [connectingcommuters.org](http://connectingcommuters.org)

**GREEN MOUNTAIN RAILROAD** - Day trips from White River, Champlain Valley, Bellows Falls and Rutland. [rails-vt.com](http://rails-vt.com)

**GREEN MOUNTAIN TRANSIT AGENCY** - Local service in Barre, Montpelier, Grand Isle, Stowe and Lamoille. 802-223-7287 [gmtaride.org](http://gmtaride.org)

**GREY HOUND/VERMONT TRANSIT** - Long distance bus services. 1-800-231-2222 [greyhound.com/](http://greyhound.com/)

**LAKE CHAMPLAIN FERRIES** - Transport between New York and Vermont via Lake Champlain. 802-864-9804 [ferries.com](http://ferries.com)

**MARBLE VALLEY REGIONAL TRANSIT** - For Rutland, Killington, rural Manchester, Poultny and Rutland to Bellows Falls. City routes Free on Saturday. 802-773-3244 [thebus.com/](http://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 [ridect.org](http://ridect.org)

**STAGE COACH** - Buses from Randolph and Fairlee to Dartmouth, & local village. 800-427-3553 [stagecoach-rides.org](http://stagecoach-rides.org)

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# FUEL FROM WASTE AT THE PUMPS

By George Harvey

It was not all that long ago that waste of all kinds was simply dumped into rivers. There were no laws to protect the environment, and conventional 'wisdom' was that the environment could absorb just about anything we wanted to throw at it, from plastic bags to plutonium.

Today, we are seeing a better way emerging. We are starting to understand the value of waste. It is not something to throw away – it is too valuable. Whether it is landfill waste, manure or human waste, food scraps, or previously unusable agricultural by-products, it is worth money. Why? The reason is that it can be converted to fuel or feedstock for a variety of things ranging from automotive fuel to plastics.

Last fall had a number of interesting news stories about waste. Each was of itself rather small, but when they are seen together, they show a trend that may eventually be highly significant.

One story is about 'bio-methane,' a drop-in replacement for natural gas. It has been used for some years to fuel power plants, but the news had a new twist. A company called Clean Energy is marketing bio-methane, under the trade name, "Redeem." They have put it on sale in over thirty gas stations in California, where vehicles equipped to run on natural gas can fill up.

The process of making Redeem takes municipal or agricultural waste and turns it into a number of different things. One is bio-methane. Another is compost that can be used agriculturally. By-products exist, but they are relatively benign. The process uses agriculture waste that would otherwise decompose partly to methane, which, if uncontrolled, is far worse than the carbon dioxide released by vehicles. The carbon atoms in the process were recently in the atmosphere, and the fact that the carbon is being recycled through the atmosphere makes it possible to regard the process as carbon-neutral.

In some places, bio-methane is already being run into existing natural gas lines. As a by-product of agricultural and municipal waste, it

can be less expensive. It requires some processing before it can go into the lines, however, and does require a bit of attention from the people who make it.

On the plus sides, it is a product that can be made wherever there are farms or municipal waste, and it does not require extensive, continental-scale transportation infrastructure. Other benefits are that when it is properly made, it does not contain sulfur compounds or radon, and so it can be cleaner than natural gas, entirely apart from the fact that the carbon footprint is at worst tiny, compared to natural gas with a much larger carbon load.

It is somewhat costly, but methane can be converted to such things as gasoline and diesel oil, along with such lighter fuels as butane and propane. The processes that are used to do this have been known since the 1930's and before. So, as newer, more efficient, and less costly processes are developed and the prices of fossil fuels increase, we are also likely to see gas-to-liquid plants built making local fuel from local waste.

Right now, bio-methane is about the same price as natural gas at the gas stations that sell it, which makes it less expensive than gasoline or diesel oil. As technology for making it improves and the costs of fossil fuels continue to go up, we can doubtless expect to see more of it. ♪



Vehicles that run on natural gas can run on bio-methane. Photo courtesy of Clean Energy®

## ALL ABOARD! RAIL IN VERMONT

Cont. from page 4

carry-on bikes on Amtrak trains, working with the Vermont Bike-Ped Coalition and the state of Vermont. We can now report that Amtrak has tested a car with bike racks, and details are being worked out for this service on the Vermonter and Ethan Allen.

### Trains to Montreal

The cost to extend the Vermonter to our nearest big city is low, but the complexity of dealing with two customs services and Canadian unions is high. We do need the support of congress members beyond Vermont and New York to finish the work. Please spread the word among your friends in other states to write their representatives.

Regional Cooperation. VRAN works in affiliation with Trainriders/Northeast

of Maine, the National Association of Railroad Passengers and other regional advocacy groups.

### Commuter Trains in Burlington

We've had conversations and helped refine plans for a future effort to establish a Middlebury-Burlington-Essex Junction - Saint Albans/Montpelier Junction network.

### Converting Freight Shipments to Rail

We are pursuing several opportunities to convert significant truck flows in Vermont to rail freight. This has involved putting together 'win-win' proposals that make rail shipment attractive as well as profitable. Our role is to bring people together.

Christopher Parker is the Vermont Rail Action Network Executive Director.

The new VRANS website at [www.RailVermont.org](http://www.RailVermont.org). The number is 802-579-3394. ♪

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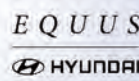
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# WITH THE CAR UNDER SCRUTINY, CARGOBIKES ARE ON THE RISE

By Dave Cohen

Chickadee came up to them. "Nobody around," she said in her small, dry voice, "but there's one of those fast turtle things coming." Horse nodded, but kept going forward... and then in the distance something moving fast, too fast, burning across the ground straight at them at terrible speed. "Run!" she yelled to Horse, "run away! Run!" As if released from bonds he wheeled and ran, flat out, in great reaching strides, away from the fiery burning chariot, the smell of acid, iron, death.

In this passage from Ursula Le Guin's short story "Buffalo Gals, Won't You Come out Tonight," animals glimpse a familiar moving object blazing toward them. To us, that object "burning across the ground straight at them at terrible speed" is so easily articulated in our familiar coded language - "car" or "automobile." But to the greater world it is experienced as something profoundly different.

Any way you look at it, the unbridled deployment of the massive number of automobiles on our landscape is deeply undermining our bodies, our soundscapes, our sense of place, the global ecology and so many nooks and crannies of this world we could never know about.

Thankfully, in the US we're beginning to seriously consider the impact of the automobile, and that is moving many cities forward with the implementation of better bike and pedestrian infrastructure and programs, as well as taming the car and its domination of public spaces, including our streets.

In just the past five years we've witnessed some great projects in New York City and many other municipalities, aimed specifically at boosting bike transportation - paths, lanes, bike share programs, bridge



School pickup time! Dave's Yuba ElMundo longtail cargobike with studded tires in 15° weather. The daily trip includes 1 1/2 mile climb.

access and much more. Along with these developments, a bicycle design revolution has been taking place. The most exciting part of this has been the re-emergence of the cargobike.

Recently heralded in the Wall Street

Journal as the "New Station Wagon," cargobikes may have two wheels or up to four and are either exclusively human-powered or a hybrid of human-power and electric-assist.

Cargobikes typically have features for hauling things like groceries, kids, grandma, refrigerators, or whatever else.

While cargobike designs have primarily originated out of Europe for the past 100 years or so, the current cargobike revolu-

tion is inspired by an American idea - the longtail bike.

The longtail is essentially a stretched out mountain bike - the first half with all the appearances of a typical mountain bike and the back half with enough space for children and cargo. The original concept started in the early 1990's with the Xtracycle Free Radical - an extension frame that will stretch almost any bike into a child-carrying, stuff-hauling cargobike.

The best longtails now feature fully integrated frames (see [www.yubabikes.com](http://www.yubabikes.com) and [www.xtracycle.com](http://www.xtracycle.com)) that can transport loads upwards of 400 pounds. They are packed with features like special kid's seats and rear handlebars for carrying up to three children. Also available are enormous panniers for carrying groceries, sidecar trailers, huge front baskets and an ability to tow another bike (great for bringing your kid's bike along) and much more. Longtails and a number of other cargobike designs have become increasingly popular in many communities, but in places like Portland, OR they are now a major phenomenon.

However, a most intriguing aspect of this revolution for those dealing with hills,



ElMundo with file cabinet and 50# of groceries in basket and pannier on other side.

mountains and distances, as I do in Vermont, is the electric-assist cargobike or e-cargobike. Electric-assist refers to a compact motor and battery that power either the front wheel, rear wheel or the

chain drive of a bike.

Of course, the rider still offers the purest, greenest, cleanest form of energy available - the human body. But by harnessing the amazing efficiency of the human body and, when needed, adding in the supplementary power, an e-cargobike is in many ways the ultimate hybrid utility vehicle. Now families can ride up steep inclines while carrying cargo and covering distances that would be impossible without the boost.

Furthermore, with the new lightweight lithium-ion batteries, e-bikes can now travel farther than ever before. A full battery charge can carry an e-cargobike rider upwards of 40 miles. It takes four to five hours to fully recharge a lithium-ion battery at a cost of no more than 10¢ of electricity!

So, compared to the massive batteries found in electric cars, the battery on an e-bike is just a fraction of the size and weight. Also, without a car's two-ton plus body to haul around and four thick tires that create enormous drag, e-cargobikes have a long litany of special advantages over internal combustion, hybrid, or electric cars. E-cargobikes weigh 1% to 2% of the typical

car, so the resource demands, impacts on the land, the health of our soundscape and communities, and energy consumption, the ecological and social footprint of an e-cargobike are negligible compared to any type of automobile.

And best of all, e-cargobikes augment the conviviality and quality of life of any town or city by adding in a human presence and a healthful, inspiring image that is so often missing from car-centric communities. Seeing happy parents and kids travelling together without being confined to the sensory deprivation experience of an automobile is just an absolute blast.

All that said, e-cargobikes are not a silver bullet that will solve all our transportation challenges. If you want a silver bullet you get the car. I believe some part within every one of us understands what that means, even beyond what we know about climate change, carbon footprints and endless shopping malls.

This is about abandoning the dignified use of our bodies, as well as exiling our potential for a far deeper connection to the terrain we inhabit and all the living beings we share space with. Maybe it's ultimately about a degradation of what it truly means to be a human being.

In merging with the car we become partly what it is - robotic. And we haven't yet even witnessed the coming invasion of self-driving cars - the "carbots." They're approaching way faster than you can ever imagine.

Can we hear chickadee's alarm at the "fast turtle things"? If so, perhaps our response shouldn't be about accommodating our current dystopian world. Maybe we can bring forward our human potential - our attuned senses, strong bodies, emotional intelligence, and imaginative minds - fully engaged to work towards creating a world we and our children actually want to live in. I think that's exactly the moment when something like the cargobike will truly shine.

Dave Cohen ([www.davecohencounseling.com](http://www.davecohencounseling.com)), is a psychotherapist and an ecopsychologist in Brattleboro, VT, blending body-oriented and mindfulness therapies with approaches that draw on



Erin Maile O'Keefe at the Brattleboro Coop on her Yuba Boda Boda mid-tail bike with electric-assist.

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the healing potential of the natural world. As founder of Pedal Express, a nationally-recognized cargobike delivery service in Berkeley, CA, he continues to ride and promote really big bikes for everyday use. He and his family are sighted nearly daily on their bright orange e-cargobike in the Brattleboro area. 🐦



## ANTIOCH STUDENTS AND MSN BRINGING COMMUNITY SOLAR TO MONADNOCK REGION

By Tracy Bartella

This spring, a group of five students from Antioch University New England are teaming up with the Monadnock Sustainability Network to bring community solar to the Monadnock region.

Gaining in recent popularity across the United States, community solar projects are cooperatively owned systems that provide energy and financial benefit to multiple members of the community. The adoption of the title Monadnock Community Solar Initiative, or MCSi, is a reflection of the group's strong focus on local community and solar energy, even including in its name the symbol for the element silicon (Si), a primary component of solar cells.

Mari Brunner, an Antioch student completing this project for credit toward her Master's in Environmental Studies, is excited about the community solar initiative because she sees it as a great opportunity for people throughout the community to invest in renewable energy, support fellow community members, and gain a small financial return themselves. She also highlights the long term benefits of community solar projects, including greater innovation within the energy sector. "Community solar has many benefits," she said. "It is a hedge against rising fuel costs, it reduces emissions of pollutants and carbon, and it drives energy independence."

Falling installation costs and creative new financing models have made solar projects more financially feasible, and funders can expect to see a return on investment in as little as five years. "Community solar is an emerging segment of the fast paced solar market," states John Kondos, a founding member of the Monadnock Sustainability Network and local energy company, Solar Source. "Commercial solar continued to grow last year and large scale utility projects were the largest segment of solar installed in 2013. There are already several community solar systems just across the river in Vermont." Kondos went on to explain, "The Monadnock Community Solar Initiative (MCSi) is a result of the folks behind the Brattleboro Co-op PV [solar] system speaking at Keene Green Drinks last fall. If they can do it, why can't we?"

The Antioch team will release an initial feasibility study for the project in mid-March and propose siting alternatives for the final location of the solar electricity system. MCSi is currently looking to form a group of core citizens who will help develop, fund, and implement the project. Local citizens interested in learning more about this exciting opportunity should contact John Kondos at [jkondos@home-efficiency.com](mailto:jkondos@home-efficiency.com) for more information.

Tracy Bartella is part of the Antioch University student project group that is working with the Monadnock Sustainability Network to initiate this community solar project in the Monadnock region.

## SOLARIZE NORWICH 2014 CAMPAIGN LAUNCHED

Through the two successful Solarize Norwich campaigns in 2012 and 2013, total residential solar PV capacity in Norwich has grown from about 143kW to 267kW -- close to doubling! Their new goal is to top 400kW in 2014.

Once again they will be working with two Norwich-based firms, Norwich Technologies and Solaflect. The two companies have focused on reducing the costs related to the support and mounting structures for, respectively, roof- or ground-mounted fixed and pole-mounted tracking solar systems. Depending on your site, at least one of these set-ups is likely to be a good match.

The campaign includes a community solar option suitable for renters or homeowners whose sites are shady, making PV there not feasible.

This is another opportunity for Norwich residents to take action to cut both their personal energy bills and their carbon footprints. To learn more, contact Linda Gray ([linda.c.gray@gmail.com](mailto:linda.c.gray@gmail.com)).

## SOLARIZE UPPER VALLEY PROGRESS CONTINUES

By Sarah Simonds

In the December issue of Green Energy Times, we announced Solarize Upper Valley, a new program from Vital Communities which teams up communities with local solar PV installers for a series of 15-week outreach campaigns aimed at doubling existing residential solar PV in each community.

Spring 2014 Solarize Upper Valley Communities were selected last month:

- Solarize Cornish-Plainfield!
- Solarize Lyme!
- Solarize Strafford-Thetford!

The three communities will be reviewing bids and selecting their partner installers at the end of February.

Though Solarize Upper Valley will officially kick off in March, teams of community volunteers have already met to begin planning outreach activities between now and the June 30 program deadline. If you live in one of the Spring 2014 Solarize Upper Valley Communities, you can expect to learn more at your town meeting.

The Spring 2014 Solarize Upper Valley Communities will each host a Solarize launch event in March, followed by workshops, open-houses, tables, posters and more. All this is designed to connect residents with highly competitive pricing and trustworthy resources to make the process of going solar as simple and rewarding as possible.

Be sure to check online for upcoming Solarize news and events, to sign up for Solarize email updates, and to learn more about how to get involved. [www.VitalCommunities.org/Solarize](http://www.VitalCommunities.org/Solarize)

Even if you don't live in one of the Spring 2014 Solarize Communities, visit the Solarize Upper Valley website this spring for useful resources about solar energy opportunities in the Upper Valley, for individuals and communities alike. Questions? Contact Sarah Simonds: [Sarah@VitalCommunities.org](mailto:Sarah@VitalCommunities.org).

## WHAT COSTS LESS THAN RENEWABLES?

By George Harvey

People with conventional ideas about renewable power seem to cling to the notion that they are expensive. Such ideas are flat-out wrong. The time has come when renewable power is less expensive than nuclear and fossil fuels.

Green Energy Times has already published articles saying that in many places ordinary people can get power from their own solar PVs less expensively than by buying it from utilities. Now we see the same sort of price changes expanding to other parts of the market.

Reviewing the trends of power over the past year, we find that power from natural gas is being supplied in long-term contracts for prices as low as \$45 per MWh, though it would take \$60 to justify building a new plant. This is a killer for nuclear, and was cited as one of the reasons the Vermont Yankee nuclear plant is being shut down.

By comparison, the lowest price for long-term contracts for wind power from Texas wind farms is about \$25 per MWh, with contracts regularly being signed at below \$30. Take away Federal incentives, and it would be about \$50. This is already too low for new natural gas plants to be

competitive, but future projections make it even harder. The fields of fracked gas are seeing huge declines in productivity, in some cases nearly 50% per year, so the price of natural gas is very likely to increase sharply, but the price of windpower is expected to continue its decline, as new technology makes turbines more efficient.

The price of solar power is also going down so far that solar can compete in many places on an even footing, not only with nuclear and coal, but natural gas as well. Late last December, in a Minnesota court case, a set of solar installations was chosen over natural gas based on the price of power. This was done in a direct, official comparison, without subsidies from the state or federal governments. It was the first time such a comparison decided in favor of solar, but it will probably not be the last. Again, this is because the costs of renewables are going down while those of nuclear and fossil fuels are going up.

So to answer our headline question, we are now finding a clear answer: "Nothing costs less than renewables." And this is as it should be, because the sunshine and wind are free.

## SOLARIZE PUTNEY SOLARIZE WINDHAM COUNTY!

By Daniel Hoviss

The Putney (VT) Energy Committee in partnership with two renewable energy companies presents an affordable alternative to the high up-front cost of solar installations -- Solarize Putney. This program seeks to increase the use of small-scale renewable energy in the Putney area. This model will reduce costs for all participants by providing a competitively tiered pricing structure. As more home and business owners sign contracts for systems, the price of each system will decrease, increasing the savings for everyone.

PEC is partnering with RGS Energy (formally Real Goods Solar) for solar electric installations, and with Sunward Systems for solar hot water and space heating needs. Both companies are collaborating to provide customers with affordable, reliable, renewable energy. Both ground- and roof-mount options will be available from each company.

Solarize Putney will hold a kick-off event on Saturday, March 15th at the Putney Community Center. The evening will begin with a 6:00 pm dessert potluck followed by a brief presentation "solar makes economic sense," and culminate with live music and dancing. Real Goods Solar and Sunward Systems will have representatives at the event that will be happy to talk about your needs.

Customers who join the program at the kickoff event will receive an extra incentive discount.

Here's how Solarize Putney will work. Home and business owners who want to participate will pay a small, refundable deposit. Installers will provide a site assessment, an estimate for the cost of the installation, an explanation of the

state and federal rebates and incentives that are available and a net payback period or return on investment calculation. Participants who sign a contract for the work will make a down payment, and once the system is completed, a final payment. In addition to state and federal incentives, home and business owners who sign up early may also be eligible for Solarize Putney incentives. Businesses may also receive other tax advantages during the first five years after installation.

Through the Solarize Putney program, Putney Energy Committee volunteers aim to increase the adoption of small-scale solar hot water and electricity systems and reduce our town, and area's, reliance on fossil fuels and imported energy.

Contact Daniel Hoviss 802.254.1410 or [Daniel@putney.net](mailto:Daniel@putney.net) for more information or to schedule a site visit in the Putney area.

The program is modeled on Solarize Northampton, through which more than 110 homeowners installed 739 kW of solar electric systems. The 2011 and 2012 Solarize Mass programs resulted in more than 900 residents and business owners in 21 communities installing 5.6 megawatts of solar electricity.

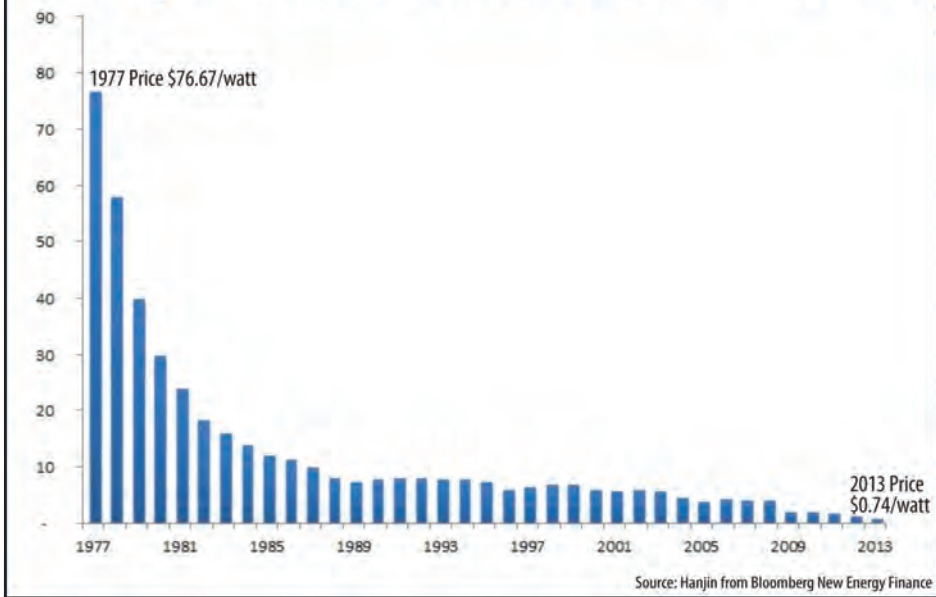
The Solarize Windham program will roll out across other towns in Windham County during 2014, following the successful model of Solarize programs in central Vermont and western Massachusetts. If you are located in Windham County, VT, and want to get your community involved, schedule a site visit or want more information about the Solarize Windham program, contact Tad Montgomery of Home Energy Advocates: 802-251-0502 [Tad@HomeEnergyAdvocates.com](mailto:Tad@HomeEnergyAdvocates.com).



# SOLAR PV

## SOLAR IS NOT TOO EXPENSIVE - SOLAR COSTS LESS THAN YOUR ELECTRIC BILL!

Price of Crystalline Silicon Photovoltaic Cells \$/watt 1977 - 2013



of the actual life of the solar systems. There is no real clear idea of how long they last because so far, nearly all of them just keep working. Normally, they simply do not wear out.

Should you act now, or later?

The SunShot Initiative, part of the US DOE, is aiming to reduce the installed costs of solar to \$1/watt by 2020. There is reason to believe they could succeed. The current problem with the price of solar power is the so-called soft costs, including permits, licenses, and such business costs as advertising. Reduce these, and there is a substantial reduction in the cost of solar.

This brings up the question of whether it would not be better to wait until costs go down even more. The answer is simple. Since you start reducing your costs immediately, waiting until later involves buying grid power, probably at increasing rates, for years before you act. The longer you wait, the more you will have paid into the grid.

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So the bottom line is that there may be no better time than right now to buy solar PVs. There may not ever be a better time than NOW to go solar. If you can afford to buy electricity, you CAN afford solar power! Is there a better investment that you can make - for yourself or for our future? ☀



Cont. from page 1

and tax credits. This means you would be paying 14¢/kWh for your own solar electric generator, which is almost certainly less than you currently pay for grid electricity from your utility.

You ARE already at below grid parity even before incentives! Add in incentives and the cost of solar electricity is typically under 10¢/kWh for clean, renewable, locally generated solar electricity! Even with financing, at today's low interest rates and long terms, your monthly payments should be lower than grid electricity would cost. The solar PV will replace your electric bill -- you will not have two bills.

Solar PVs can provide a fixed rate for power until they are paid off, for which utilities cannot offer. It gets even better after they are paid off, because that is when the electricity becomes free. Also, the warranted period is probably just a portion

### Solar Costs - From 2004 to 2014



**In 2004, this 3.8kW off-grid ground-mounted solar pv system was designed to produce 11.5 kWh/day. Installed Cost: \$34,500 (\$9/W)**  
**In 2014, the cost for a comparable 3.8kW system: \$15,200 (\$4/W)**

**Photovoltaic system:** 24 BP 160 W, 12 VDC panels (3,840 W, 48 VDC); 3 Pole-mounted UniRacs; Trace/Xantrex SW4048 Inverter (4000 W); 2 Outback MX 60 MPPT charge-controllers; 3 array combiner boxes; 4 lightning protectors

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# SOLAR POWER AND HEAT PUMPS

*New Inverter Heat Pumps Worth Their "Salt"... Can Triple Solar PV R.O.I.*

By Mike Hamlin

New inverter heat pumps are very different from their early predecessors. The new inverter-driven technology enables the heat pump to transfer heat from the outdoors to the indoors extremely efficiently and reliably at temperatures well below 0°. The use of "intelligent" "smart controls" allows for the heat pump to ramp up and down as needed, thus making the inverter the most efficient heat pump ever produced. So, how can an inverter heat pump triple a PV solar array's return on investment (R.O.I.)? Let's do the math.

Let's take a modest new energy-efficient home of say 1900 sq. ft. with two people living in it. General electrical usage would be approximately 6000kWh annually, including an electric hot water heater. Annual heating BTU's would be approximately 60,000,000 (60MMBTU).

The new home has been equipped with a "Net-0" 6kW solar array to cover the annual electrical needs and has a highly efficient 95.5% A.F.U.E propane furnace. Electrical rates in the region are @ 16.3¢/KWH (kilowatt hour) and propane costs are \$3.69 per gallon.

A KWH is equal to 3,410 BTU's. A gallon of propane is equal to 91,500 BTU's and @ 95.5% A.F.U.E. has 87,383 usable heating BTU's. Annual electrical cost \$.163/kWh for 6000kWh would be \$978.00 which is the R.O.I. of the PV solar array. A recent advertisement for a 6kW solar array was \$19,500.00 installed. Federal, state and utility rebates totaled \$12,100.00, leaving a net cost of \$7,400.00. So, the \$978.00 savings divided by the \$7,400.00 PV net cost generates a 13.2% R.O.I. or 7.57 year pay-back. The propane furnace on the other hand, will burn 687 gallons of propane to produce 60MMBTU's at a cost of \$3.69 X 687 or \$2,535.00 annually.

Now, let's replace the propane furnace with a 36 MBTU inverter heat pump system. The heat pump transfers

heat-using electricity. There are 17,595 kilowatts in 60 MMBTUS. That is 2.93 times what our PV system produces annually. If we were heating with straight electric baseboard or an electric furnace then we would need 17,595kW's to generate the annual heat needed. That would cost a whopping \$2,868.00. But, wait a minute, we're not generating heat with a heat pump, we're just moving it from one place to another, so we don't need anywhere near that much electricity. As a matter of fact, heat pumps can move as much as 4.2 times the heat as the heat value in the amount electric power they use. We however, will be very conservative and will use a 10.3 HSPF adjustment or 3 coefficient of performance (C.O.P.) rather than a 4.2 C.O.P. This is known as the Heating Season Performance Factor (HSPF). So, let's divide 17,595kW by a 3 C.O.P. and we only need 5865kW to produce 60MMBTU. That's actually 135kWh less than our PV array produces.

Now, here is the bottom line. We saved \$2,535.00 in propane costs using a heat pump. We had 135-kw left over for the general electricity, at a savings of .163 cents x 135 or \$22.00. Our total savings are now \$2,557.00 or 36% R.O.I., and a 2.89 year pay-back on the PV installation net cost. Additional general

electricity cost for the remaining 5865kW needed will cost \$955.00, so we are ahead by \$1,602.00 with a heat pump compared with a propane furnace. A 12kW PV array would "net-zero" our total electricity usage. So if we spent \$14,800.00 for PV's and our savings were \$2,557.00 + \$955.00 (\$3,512.00) our R.O.I. would be 24%, or 4.21 year pay-back.

In 20 years at today's prices, we will have saved \$55,454.00. Further, 13,740 gallons of propane would be saved along with the energy that would be consumed to produce and transport that much propane over a period of twenty years.

Mike Hamlin is a recognized expert on both solar power and HVAC. He has worked with HVAC for over 40 years, and has logged over 12,000 hours on cutting-edge systems. He has designed and overseen hundreds of installations with heat pumps in

many configurations. He also lectures on solar power. He works for Seely Heating, Plumbing, and Air Conditioning in Meredith, NH.

*A projected system with PVs powering a heat pump has a 4.21 year pay-back period and saves \$55,454 over 20 years.*

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# G.E.T.TING TO KNOW YOUR SOLAR INSTALLERS

## INTEGRATED SOLAR APPLICATIONS CORP., BRATTLEBORO, VT

### Staff Article

This is the first of many in our new feature that we will be running in Green Energy Times, which will be highlighting our local solar installers. ...

As one of our longer standing Solar Installation companies in our region we would like to introduce you all to Integrated Solar Applications Corp. (ISA), 121 Spring Tree Rd, Brattleboro, Vermont.

ISA was founded in 1975 by Alain Ratheau, an electrical and mechanical engineer. In those days the organization was the Solar Applications Company. Over the years, Alain designed and installed both solar thermal and solar PV systems.

In April 2008, Andrew Cay acquired Solar Applications Company and changed the name to reflect a focus on combining technologies to achieve net-zero energy solutions. Andy had received a BS in Mechanical Engineering from Worcester Polytechnic Institute with Distinction and an MBA from the University of North Carolina, before being involved in a number of capacities in the fields of engineering, energy efficient housing, and real estate.

Andy put together a team with a very diverse background. The result is that ISA can handle a good deal more than a simple set of solar PV solutions. They can work on small wind turbines, geothermal applications, and solar hot water. And Alain continues to work with ISA as a lead engineer and system designer, giving a sense of long-term continuity to the business.

Continuity goes beyond the presence of

long-term staff. ISA has repeat customers with a sense of customer loyalty. In fact Andy Cay's first customer, Abenague Car Wash, has come back for seconds, a repeat of the same design at a different site.

ISA is able to design for solar PV, solar thermal, and heat pumps to produce an Integrated System. For example, a PV system can be built to provide power for a geothermal heat pump. If the system is designed, installed and maintained at optimum size and capacity, it can be a Net Zero system, meaning that the sun powers the buildings heat in a way that is more efficient than even direct heating. If other things are needed, such as air-source heat pumps or wind turbines, ISA is happy to connect clients with people who specialize in those sorts of things.

The range of work ISA does is quite broad. They design and build small household power and heat systems. They also work on commercial and industrial systems, and community and municipal systems of all sizes. They have been at this like of work for almost 40 years, and have a wide range of installations they can show.

Andy Cay, owner of ISA, was good enough to answer a few of questions for Green Energy Times:

### Q: What are your thoughts about solar and climate change?

A: "Solar is a very important arrow in the quiver - part of the solution - an important part of the solution to help combat climate change. Combined with geothermal, wind, and hydro, we can have a renewable energy future."

### Q: What led you to buy this company in 2008?

A: "I was developing real estate and worked with Alain Ratheau, who helped to install solar on some projects. Al Gore's Inconvenient Truth came out just before this, and it had big impact on me. He had a very compelling argument. The move was the right fit for me personally - it was where my heart wanted to go. I have a building and engineering degree, VT plumbers license, a BS in Mechanical Engineering, and an MBA in Business."

### Q: I notice you mentioned a VT Plumbing license. I recall featuring a story about you a few years ago in Green Energy Times about a SHW powered carwash there in Brattleboro. Did you start out with SHW installations?

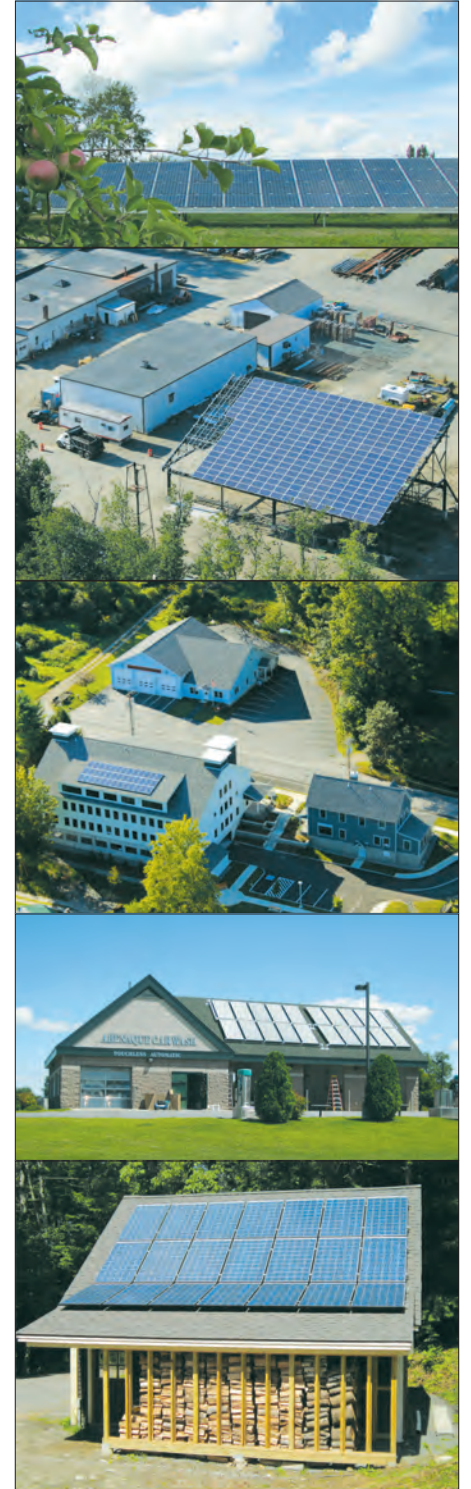
A: "Yes, I did start out with Solar Thermal systems. The Abenague Car Wash is doing very well. In fact, in Chester, VT, we are installing a 2nd one, designed exactly like that one. It is doing well enough that they want to do it again. 120° water is perfect for car washes. Laundromats are also well suited for Solar Hot Water. When the oil prices went up to \$4.75/gal, solar thermal was a great alternative. Solar thermal is still an attractive technology. But since then, Solar PV has dropped dramatically from \$9-\$10/Watt in 2008 to \$4/W today, so PV is now dominating the market. Even in 2008, photovoltaics were a good choice, but it an even better choice now."

### Q: What kind of totals for Solar PV have the past years been for Integrated Solar?

A: From 2012 to 2013, installations increased by 50%. They installed 770kW total solar in 2013. ISA has 4 MW solar PV projected for 2014 -- more than another 50% from last year.

Andy points out that the federal incentives program may end in 2016. Federal tax credits have been a major driver of the solar industry, and a sense of urgency is developing, as we get closer to that date. We will have to see how the next steps develop, as laws may be revised before then.

Learn more at (802)257-7493 | [www.ISASolar.com](http://www.ISASolar.com)



ISA solar projects: Wallace with Apples, Renaud Bros., Algiers, Burtco Car, Wash, Peake. AND the end add "All photos courtesy of ISA"

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# BISTRO HENRY IS SOUTHERN VERMONT'S FIRST 100% SOLAR-POWERED RESTAURANT

Staff Article

A system at Bistro Henry in Manchester, Vermont is the largest solar tracking project in the region. It will provide all the energy needed for lighting, refrigeration, and air-conditioning at Bistro Henry, with some left over for heating. With 60kW of PVs, mounted on ten dual-axis AllSun Trackers, the system will produce about 87,000kWh annually. The net-metering credits it produces will be shared with the Inn at Manchester and the owner's household.

"I am proud to say that Bistro Henry is the Greenest Restaurant in Manchester and has been a leader in sustainable business practices," owner Henry Bronson said. "In 2010, we installed a solar thermal system to heat the restaurant's water and now we are thrilled to have our restaurant become solar powered, too!"

"We've taken many steps to save energy and to be a green business. We've been recycling for 20 years, compost our food waste, and burn used vegetable oil in the diesel truck. Two years ago we installed

LED and highly efficient modern fluorescent lighting. We have brushless fans in our coolers and do regular cooler gasket maintenance. Low-flow toilets and faucet aerators, as well as a highly efficient propane furnace, add to these green improvements. The bottom line for us is that they save us money! It makes good business sense to be smart and save energy."

Frank Hanes of the Inn at Manchester added, "We support all efforts that create opportunities for sustainable alternative energy options. It's forward thinking. Utilizing local surplus power from the sun helps us lessen the footprint that The Inn at Manchester leaves on the planet - that's important to everyone here."

Bistro Henry's system is connected to the grid through a net-metering agreement with Green Mountain Power. Excess energy is sent to the grid during peak production periods. The restaurant draws power from the grid as needed. Green Mountain Power credits full retail value for energy sent to the grid plus 6¢/kWh.

The innovative system was designed,

built, and installed by Solar Pro of Arlington, VT and AllEarth Renewables of Williston, VT. Solar Pro has installed over 75 solar systems in southern Vermont. Karen Lee of Solar Pro commented, "The Bistro Henry solar tracker project is an exciting project for us. Solar Pro is proud to be a part of their Green Success Story. We're pleased to be able to offer our customers a highly innovative product, manufactured in Vermont, that will provide energy sav-

ings from the sun."

The highly innovative AllSun Tracker system is manufactured by AllEarth Renewables in Williston. They have installed over 1,600 systems over the past four years.

Bistro Henry can be contacted at (802)362-4982 or by visiting [www.bistrohenry.com](http://www.bistrohenry.com).

Solar Pro's website is [www.hotonsolar.com](http://www.hotonsolar.com).

AllEarth Renewables' site is [www.allearthrenewables.com](http://www.allearthrenewables.com)



Bistro Henry's 60kW PV system is producing power for the restaurant, inn and the Bronson household -- Manchester, VT. Photo courtesy of SolarPro.

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# SOLAR NEWS FOR THE SOLAR CAPITAL RUTLAND, VT

**2014 brings Rutland closer to their designated goal to become the Solar Capital of the Northeast. A rooftop solar farm and a new Solar Center total nearly 240kW of additional solar commissioned in January!**

By N.R. Mallery

On Tuesday, January 21st, 2014, Green Mountain Power commissioned Rutland's newest solar farm, which is located at the College of Saint Joseph. The 98.28kW project at the CSJ is a fully ballasted roof mount solar photovoltaic system that is atop the college gymnasium.

Positive Energy won the competitive GMP bid to design and install the system.



Rutland's newest solar farm -- at the College of Saint Joseph. The 98.28kW project is a fully ballasted roof mount solar photovoltaic system, atop the college gymnasium. Photo: Positive Energy.

It is likely one of the largest rooftop systems in the Rutland area, if not beyond. The project employs US-assembled SolarWorld modules, and a single Solectria inverter that is mounted at the ground level. The installation of the array was completed in under a week, and total construction of the project was wrapped up in just over 2 weeks. Khanti Monroe, VP of Solar Operations for Positive Energy commented, "Working with CSJ and GMP was a real pleasure, and a model example for how to replicate these types of projects going forward." The project also includes an interactive digital display that allows visitors to see the output and environmental benefits of the project in real time.

This project is an interesting partnership with the CSJ and Green Mountain Power. Green Mountain Power will own the project and lease the rooftop from the college. Positive Energy, who installed the rooftop solar farm, is from Middle Granville, NY. They have been involved with some of the other large solar farm installations that are also connected to the Solar Capital project.

Adding to efforts to make Rutland the solar capital of New England, the Solar Center at Rutland Regional Medical Center went on-line on January 14, 2014. The ceremony was held in the pouring rain. Philip Allen of SameSun Solar, who built the Solar Center, pointed out that "Steve Costello made an excellent point at the ceremony when he was able to show that the array was producing nicely even in this terrible weather!"

The 140.4kW solar farm was



Steve Costello of GMP and Tom Huebner of Rutland Regional Medical Center on Jan. 14, 2014, in the rain. Photo courtesy of SameSun Solar

built through collaboration between Green Mountain Power and Rutland Regional Medical Center. It showcases a touch-screen production monitor, a walking path and educational materials for visitors. Visitors to Green Mountain Power's downtown Energy Innovation Center can also track the production of the new solar farm on a digital display, which shows how much energy is produced, the amount of coal required to produce the same amount of energy, and related data.

"The Solar Center at Rutland Regional is



The 140.4kW Solar Center at Rutland Regional Medical Ctr. in Nov., as construction was wrapping up. Photo: Green Mountain Power.

already making an impact, demonstrating to our employees, patients and visitors that we are committed to environmental sustainability and economic development in the region," President Thomas Huebner said at the ceremony marking the project's completion. "We are proud to be contributing to Rutland's revitalization, and hope this first project at the medical center is a precursor to other projects."

"Rutland Regional proved to be a perfect partner on this project," said Mary Powell, president and CEO of GMP. "Medical center staff were highly engaged and easy to work with. The project will help meet local peak loads, produce energy close to where it is consumed, reduce our carbon footprint, and help build the local economy. Projects like this are supporting new local jobs and business development in the Rutland area."

"It's a meaningful project, fitting in beautifully with the landscape and surrounding buildings," said Philip Allen, who owns Same Sun with his wife Marlene. She added, "It's exciting to be a part of the new solar economy in Rutland."

GMP, which will own and maintain the solar farm under a 25-year lease agreement with Rutland Regional, will credit the hospital for 10% of the project's output. The remaining energy will be delivered to other local GMP customers.

These projects are part of GMP's ongoing work to make Rutland the solar capital of New England, the city with the highest solar capacity per capita of any city in New England. The effort supports Vermont's goals to substantially expand renewable generation, and GMP's commitment to support new economic development in Rutland.

Learn more about the Solar Capital Project at [www.greenmountainpower.com](http://www.greenmountainpower.com).

## GET MORE ENERGY FROM YOUR SOLAR IN THE WINTER

By N. R. Mallery

So, you've invested in a solar system. Why? To be able to produce clean renewable energy, save on your energy bills, personal energy independence, and you might even have considered the future of the planet in your mix of reasons.

Here comes winter, with snow and ice now covering our solar panels. There goes your energy production -- until the wind and sunshine come along, eventually melting the snow or blowing it off -- if you're lucky.

Waiting for Mother Nature's help doesn't always work. Is there another option?

My own manually adjustable racking system takes 10 to 15 minutes to change the angles of all three pole-mounted racks. Since the goal is to produce as much energy as possible from the resulting solar gain, we adjust the racks to accommodate for the winter angle of the sun. It also encourages the snow to slide off. But, most often, the snow still sticks.

I am off-grid, very aware of and reliant on how much energy the solar system produces. When the snow stops, you can bet that I am out there clearing the snow off of the solar panels.

In the past I retrofitted a foam broom that only came with a pole long enough to clear a vehicle off. We replaced it with a longer wooden pole, but it was still a struggle to reach the very top of all the solar panels. Though that setup worked

ok, it was definitely limited.

I recently discovered a better solution that I recommend to anyone who has invested in solar: the Snowpro Brum from RoofRack.com. It is manufactured in the USA and is made for cleaning off solar panels! The durable polyethylene foam is rugged enough to tackle snow and soft enough to not harm your solar panels or roof. The dark part of the foam head is softer foam and under that is denser foam with a hard red plastic center into which the telescoping pole is threaded.

The lightweight telescoping pole reaches to a manageable 24-foot length. Now I can also reach the solar hot water panels on my roof, too! The company does offer a German-made pole that reaches up to 30 feet. Those Germans and their solar do it again!

There are more attachments available such as an angle adapter that could be used when additional down-force is necessary or to raise the bar up from the head on a shallow pitch roof or system. The same pole can also accommodate a roof rake attachment, squeegee and even one to help you put up those LED lights on tall Christmas trees.

The instructions for using the Snowpro Brum suggest that you move the snow off the solar panels rather than pulling it all down. Because the pole threads into the center of the head you can both push or pull snow off.

We all want to produce as much power from our solar investment as possible. Isn't it a good idea to take the time to remove the snow and accomplish just that? I personally think it is well worth the little bit of inconvenience. While there are some

installations that are not set up for snow removal, most solar-powered homeowners and businesses in the northern part of the USA might want to consider its value. You can find the Snowpro Brum at [roofrake.com](http://roofrake.com) or 734-560-7153.



Cleaning off snow from ground-mounted solar panels (PV) with the SnoPro Brum. Inset: Cleaning off roof-mounted Solar Hot Water Panels with pole extended.



# SOLAR PHOTOVOLTAICS

## AN (ALMOST) NEW SOLAR INSTALLER

By GET staff

The Sherwin Solar Store is a new solar installer in Essex Junction, Vermont. Or perhaps we should say it is "almost new." The store's background can be traced back seventy years, to the opening of Sherwin Electric Company, an organization that proclaims itself "a proud union contractor since 1943."

Starting with plenty of experience with electricity gave the store a head start on the work it set out to do. For one thing, it meant a staff of professionals was already on-board. As a member of the USA Solar Store network, Sherwin was able to get support and experience from a large number of other installers and training. Moving into solar installations was a natural move.

Since the beginning of the summer of 2013, Sherwin Solar Store has made a series of interesting and very different installations, each with its own need for attention to design details.

One job was a 1kW system installed to offset some of the cost of a pool pump running through the summer. Four SolarWorld 250-watt panels were installed on the pool shed, with power going to an Enphase microinverter. The customer can track production online with the Enphase Enlighten communications system.

Another small system has a 1.5 kW array at an off-grid hunting camp. Six Suniva

panels supply power to a small bank of four batteries, along with a Magnum Inverter-Charger.

A 2.25 kW system with battery backup was installed in Morrisville. The Suniva panels are tied with a Schneider/Xantrex XW inverter-charger, a Midnite Solar Charge controller, and eight Full River AGM batteries. The system is built to be expanded, with an oversized inverter, for future changes when the utility allows net metering. The system's battery backup system required creating a critical-loads panel for the off-grid system.

Another example is a 4.5 kW grid-tied system in Craftsbury, installed in December. It has a Kaco Blueplanet inverter and Canadian Solar panels.

Sherwin Solar's store manager, Danielle Bombardier, is working toward becoming NABCEP-certified and hopes to help make the store more accessible to the public. She wants to be able to meet a customer's needs whether it is for design assistance, a purchase of material from a local store, installation assistance, or all three. The store has a pool of qualified electricians, and apprentices through the local IBEW's apprenticeship program, which includes solar training.

*The Sherwin Solar Store is located at 7A Morse Drive in Essex Junction, VT. Give Danielle a call at 802-316-6780.*



(top-left) Ironridge racking system for 10 PV panels, (top-right) 1kW PV system installed to offset some of the cost of a pool pump running through the summer, (bottom) 4.5 kW grid-tied PV system in Craftsbury, installed in December.

## SOLAR: 2013 AND 2014 SHOW DRAMATIC INCREASES

The rate of expansion of solar power is astonishing. The past couple issues of Green Energy Times reported the amount of new solar capacity in Massachusetts, New Hampshire, and Vermont.

We canvassed a number of installers in the area and got responses from five of them, Solar pro, All Earth Renewables, Revision Energy, Sherwin Solar, and Clean Energy Collective. Growth from 2012 to 2013 averaged 15%, ranging from a marginal decline to 100% growth, depending on such factors as changes in state supports.

Projection for growth between 2013 and 2014, however, is dramatic. All Earth Renewables expects to grow from 647 kW installed in 2013 to 5942 kW in 2014, in Maine, New Hampshire and Vermont. Clean Energy Collective expects to grow from 144 kW to 4386 installed in Massachusetts and Vermont. Combined, the

five companies project growth of 335% this year.

We received a couple of really good comments from the installers as well. Solar Pro's response said, "The biggest sources of carbon emissions in Vermont come from oil and propane space heaters and automobile tail pipes. Instead of using oil and propane to heat our buildings, Vermonters should install efficient ground- or air-source heat pumps, powered by electricity from solar panels. We should also drive hybrid or electric cars that could be charged with power from solar panels."

The response from Revision Energy included, "If every municipality in Maine dedicated just 25 acres of land to solar PV generation, the state could power 100% of its energy needs (transportation, homes, heating + electricity, AND manufacturing) from solar!"

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# A PERFECT STORM IS COMING

YOU CAN BE BLOWN ABOUT, OR IT CAN BE SMOOTH SAILING – IT IS ENTIRELY UP TO YOU.

By George Harvey

A perfect storm is coming to the fossil fuel industry and those electric utilities dependent on it. Consider the signs:

**Fossil fuels are facing increasingly strong competition in a contracting market.**

Renewables: Investments in renewable power have been rising. Investments in fossil fuels have been falling. The two were first equal in 2010, a fact that became clear when data was analyzed in 2011. Renewables are still a small part of the market, but they are real, effective competition for new investment. In a three-month period in 2013, 99% or more of all new commercial electric capacity put on the grid was from renewables.

**Efficiency:** The thing no one noticed until data on efficiency was analyzed until 2013 was that investments in efficiency were as high as investments in fossil fuels in 2010. This explains why, even though both the population and productivity are increasing, the energy market is contracting.

**Fossil fuels are seeing customers turn into competitors.**

High electric rates and low costs of renewables mean it is now possible for ordinary folk to produce their own power less expensively than buying it. This includes cost of financing. Electric generating companies are losing residential customers.

As renewables have become less expensive, big businesses have come to know it is less expensive to make their own power than to buy it, and whatever excess they make is sold. Electric generating companies are getting competition from former large customers. The list of such companies includes Google, Apple, Walmart, Ikea, Staples, Coca-Cola, and many more.

**Fossil fuels are seeing increasing costs, while their competitors' costs decline.**

The costs of solar power have declined to below \$3 per watt, for commercial installation. There is hope that they will decline to below \$1 per watt by 2020. Costs of windpower are also declining rapidly.

Costs of oil and gas are not stable. "Fracked" fields are showing declining productivity even though more and more wells are drilled. In some cases, productivity is declining at rates of nearly 50% per year. Natural gas costs are currently low, but over all are only likely to go up.

Also, continued use of fossil fuels requires ever-increasing controls of emissions. This is a problem renewables do not have to face. By comparison, renewables do not have fuel demands and are not subject to fluctuations in the fuel market.

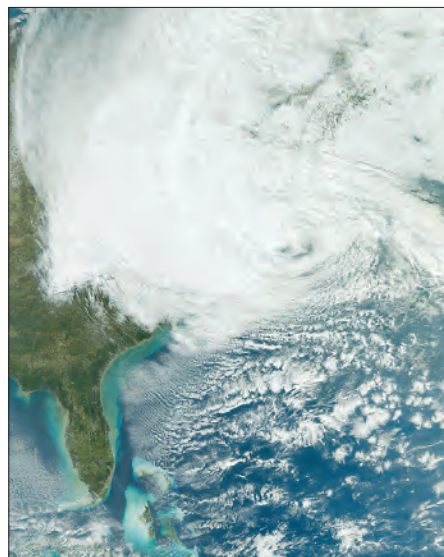
**Fossil fuels are having more trouble getting financing; at the same time, renewables are getting funding more easily.**

Since wind and solar power do not depend on fuel, it is possible to calculate their costs rather closely for very long periods. Bankers have become aware of this and other benefits. They are increasingly willing to finance renewables.

By contrast, such large financial institutions as the World Bank, European Investment Bank, and the European Bank for Reconstruction and Development are no longer willing to finance coal-based operations.

**The old ideas about intermittent and variable power from solar and wind are turning out not to be valid.**

Not long ago, some proponents of big power plants were saying that it would not be possible to run a grid that was more than 20% powered by solar and wind. This has turned out to be completely wrong in the



*The damage will not be from the weather, but it might be as bad as Sandy (pictured). Photograph by NASA.*

real world, where some countries are already normally powered by over 40% renewables already. Some have even been occasionally powered 100% by wind.

Traditional forms of power take many hours to several days to get up to speed, so they have to produce power at full capacity all night, selling power at low prices, to take advantage of the high prices of high demand periods during daytime.

Solar power can meet the daytime demand loads, eliminating high profit periods for fossil fuels. And when the sun is not shining, the wind is usually blowing. They make it much harder for old-style plants to make money.

Windpower is getting more efficient. The output of wind turbines is getting less intermittent and variable. The capacity factor, a measure of reliability of output, is approaching, and in some circumstances even exceeding, that of hydropower and traditional gas plants.

"Smart grids," with resources combined and controlled by computers, can match grid demand with the correct amount of energy production. It turns out that not only are renewables capable of powering the grid, they may do it better than fossil fuels and nuclear did.

**Political and financial pressure against fossil fuels and nuclear is increasing, and with compelling reasons for action soon.**

The high cost of fossil fuel subsidies has become clear. The worldwide cost is calculated at over \$545 billion each year by the UN. Eliminate that cost, and it is possible to finance the answer to global warming, which has the added benefits of creating jobs, keeping energy money within a country, and providing energy security. Nations are taking note.

The political pressures being brought to bear by fossil fuel companies to get their way are being matched by other, greater pressures to prevent them from doing so. Large companies have begun to notice the high costs of global warming. Major investment organizations, including retirement and mutual funds, with assets valued in the trillions of dollars, are demanding that fossil fuel producers explain how they intend to survive in a time of global warming.

Even in the transportation sector, fossil fuels are set to lose ground.

Prices of electric vehicles and batteries are declining rapidly. Volkswagen says electric cars will cost less than traditional gas-powered vehicles within three years. Including the government incentives in the US, they already do. And, they can be powered by an owner's solar panels.

Our conclusion: Forget fossil fuels; invest in renewable power. ♻️



## WHAT ABOUT WIND AND HEALTH?

By George Harvey

The idea of wind turbine syndrome was severely tested in a recent case before the Ontario Environmental Review Tribunal. It was unique in neither its attempts to stop a wind project nor in its results.

Anti-wind activists were making claims against Dufferin Wind Power, Inc., over a project in Ontario with a 99 MW capacity. They brought in some famous people to testify for them, including Sarah Laurie, who has been a physician in Australia but is no longer licensed to practice, Dr. Robert McMurtry, an orthopedic surgeon from Prince Edward Island, and Brian Howe, a sound engineer.

The tribunal determined that Sarah Laurie is not qualified to give the medical and scientific testimony she intended to make, as she was no longer licensed to make a diagnosis and had insufficient expertise to evaluate research on which she intended to testify. Similarly, Dr. McMurtry's background in orthopedic medicine did not qualify him to testify on any of the conditions that were supposed to be related to wind turbines. Mr. Howe's testimony could not provide a clear relationship between any sickness and wind turbines.

The people who were brought to testify that they had been made sick by wind turbines had similar problems. Some, who attributed specific illnesses such as diabetes, obesity, and high blood pressure to wind turbines, were shown to have had these as pre-existing conditions. Others clearly had problems, but the anti-wind side was not able to link their conditions to wind turbines. In this, as in other cases, the number of people who got sick near wind turbines was not markedly different from that of people at a much greater distance.

On the whole, those testifying against wind went somewhat beyond unconvincing. The language in the tribunal's decision seemed to indicate that they considered the testimony to be unreliable, to say the least, and perhaps intentionally untruthful.

Further, the anti-wind activists were unable to put the experience of the expert witnesses brought to testify for Dufferin Wind Power into question. The witnesses were clearly qualified and said that windpower was not known to be the cause of any health problem.

In its written conclusions, the tribunal posed a question: "From a wider context one has to question which is more dangerous to health. Living next door to Highway 401? Or living half a kilometre away from a wind turbine?" The highway had more noise, and had known pollutants that wind did not have. Unsurprisingly, the decision found that there was no reason to believe wind turbines had a negative effect on human health. ♻️



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## HOW WIND FARMS CHANGE PROPERTY VALUES

By George Harvey

On January 9, a report was published, called Relationship between Wind Turbines and Residential Property Values in Massachusetts. It is a product of a joint effort by the University of Connecticut and Lawrence Berkeley National Laboratory.

The report examines 122,000 home sales over a period between 1998 and 2012. The wind farms it covers include 26 that are already operating and 15 others. It considers a number of factors, including the sounds of wind turbines and shadow flickers that some people find objectionable.

It also considers a number of other things homes could be near, comparing these things to wind farms. We can compare other nearby features with wind farms and get a sense of which is better or worse for property values. For example, a person might ask how having a nearby wind farm might compare with having a landfill or superhighway nearby. Or on the other hand we might wonder how it compares with having nearby open land, such as a park, or a beach. The report addresses these questions.

There were 41 wind turbines specifically considered in the study. The report focused on single-family dwellings within five miles of them. A particularly important aspect of this report is that Massachusetts is very densely populated. Nearly all previous studies and considered rural settings. In Massachusetts, many or most of the homes were in urban and suburban homes.

The report also considered the variations in price as they related to the state of construction or operation of the wind farm. Prices were tracked from before the time the wind farm was first proposed, to the point that people had been able to experience what it was like to have a wind farm nearby.

The results of the study are very interesting. One thing worthy of note is that an immediate effect of the announcement of a coming wind farm is a very slight drop in property values. As the process of permitting, construction, and operation of the wind farm progresses, the property value typically recovers. In the end, the evidence, though not considered statistically significant, is that there is a slight increase in property values from nearby wind installations.

An increase in property values should not come as a surprise. Earlier studies have, in general, shown similar results. We have seen at least ten studies that were carefully done by competent, neutral organizations. Only one of these shows a very slight drop in property values, though the cause of this was not clearly associated with wind turbines. Seven others show no appreciable change. Three

## BIRD MORTALITY AND WIND TURBINES

Staff article

A new study has been released called, A Synthesis of Human-related Avian Mortality in Canada. All but one of its seven authors are from wildlife divisions of Environment Canada, a department of the federal government. The study can be found at: [ace-eco.org/vol8/iss2/art11/](http://ace-eco.org/vol8/iss2/art11/).

It has some notable information. The report says over 272 million birds are killed by human-related events in Canada each year.

It turns out that the most dangerous human-related threats to birds are housecats and their feral relatives. They are considered human-related because they are not native to North America, but were brought here by European settlers. In fact, they are considered important as an invasive species, and if they are allowed to breed and run wild, they can be very destructive. Feral cats account for over 42% of all human-related bird deaths in Canada, and domestic cats account for over 29%, for a combined total of 71.85%, or about 196 million birds each year.

The other important causes of human-related bird mortality are structures, vehicles, and direct human action. Power lines cause over 9% of human-related bird deaths. Collisions with houses cause over 8%, and road vehicles produce about 5%.

Lesser causes of human-related bird mortality include agricultural pesticides (0.99%), collisions with low and mid-rise buildings (0.88%), non-migratory bird hunting (0.88%), migratory bird hunting (0.84%), powerline electrocutions (0.18%), and water transportation (0.12%). Interestingly, communication tower collisions produce only 0.08% of human-related bird deaths, and collisions with tall buildings produce only 0.02%.

A couple more items are of interest. Gill fishing nets cause 0.0075% of human-related bird deaths. And, slightly less important, wind turbines cause 0.0061%.

Items not listed here include are the nestlings killed by haying, and the nests destroyed by commercial forestry, power



Cranes flying north past wind turbines in the background. Photo by Erell.

line maintenance, and hydroelectric production. These are not listed because they confuse the issue with such questions as whether an egg should be counted as a bird. Apart from these, however, all causes of importance equal to or greater than wind turbines are listed.

Why, you might ask, do we hear so much about wind turbines killing birds, if they don't even kill as many as gill fishing nets? Also, are the figures possibly biased in favor of wind?

To answer the second question first, we can doubt that the wildlife experts in Canada would misrepresent facts for the sake of people who might make money on running wind farms or selling wind turbines. They have no reason to do so.

As to the first question, we might answer that people who talk about wind-related bird deaths also talk about wind farms doing just about all of the following: destroying property values, raising taxes, making people sick with Wind Turbine

Syndrome, failing to provide income for the investors, destroying aquifers, destroying natural habitats, and even failing to replace the energy required to make the wind turbines. Some of these arguments are hysterical, and some are pathetically silly, but all have been soundly refuted, over and over, by peer-reviewed studies, and none seems to have been supported by articles that follow strict scientific standards.

So why would windpower be under attack? It's possibly because of the following. First, windpower represents a financial threat to die-hard fossil fuel corporations. Second, there are people who can make a lot of money benefiting the fossil fuel corporations by promoting hysteria. And third, there are people who become hysterical, to the point that they can donate time, money, and passion to a cause that only profits a select few, at the expense of the rest of the world. 🐦

## KINGDOM COMMUNITY WIND SHOWS ITS VALUE

Cont. from page 1

monitoring, independent testers take data at four sites near the wind farm, much closer than any neighbor. The site is not permitted to produce sounds louder than 45 decibels as measured at the any of the testing sites. That is about as loud as a library.

The monitoring has to be done over a period of time long enough to provide data under all conditions. The recent tests were done over a period of 1343 hours of continuous monitoring in November and December. The results were that the sound was not found to exceed limits.

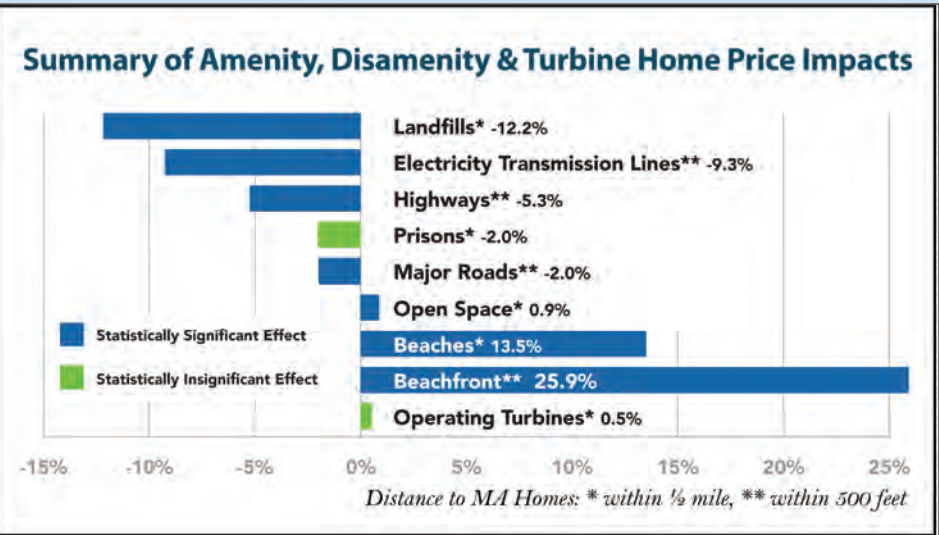
We should bear in mind that one important benefit of local power sources, including use of local fuel for those sources that use fuel, is that it keeps the money in the local economy. When the power costs to the utilities reach 60¢/kWh, not only do utilities such as Green Mountain Power lose over 40¢/kWh on each kilowatt-hour they sell to retail customers, but most of that money leaves the state. Every installation like Kingdom Community Wind makes the local economy more robust and more resilient. 🐦

show a possible to probable slight increase in property values near wind farms.

There is a reason why wind farms might increase property values. They pay taxes, but require very little in the way of municipal services, and this can reduce taxes, depending on how a state or municipality's

property tax system where a project is located is set up.

We are unaware of any study that showed a marked drop in property values resulting from construction of a nearby wind farm. 🐦



Source: Lawrence Berkley National Laboratories



# FEDERAL

## Federal Investment Tax Credit

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

## 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](http://www.rurdev.usda.gov/NH-VTHome.html) or call 802-828-6080 in VT or 603-223-6035 in NH

## Biorefinery Assistance Program

As the call for increased production of homegrown, renewable forms of fuels has grown, so has the need to develop and produce them. USDA Rural Development offers opportunities to producers to development such fuels 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](http://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/](http://www.grassrootsfund.org/grants/) or call 802-223-4622 for more info.

# VERMONT

## Clean Energy Development Fund

The The Small Scale RE Incentive Program, administered by Renewable Energy Resource Center (RERC), provides funds to help defray the costs of new solar thermal, photovoltaic, and micro-hydro systems

### Solar Incentives – based on rated capacity of system

- <http://rerc-vt.org/incentives/index.htm>
- <http://www.dsireusa.org/incentives>
- residential (including leasing)= \$0.25/Watt up to 10 kW for PV; \$1.50/100Btu/Day up to 200kBtu for ShW.
- commercial/industrial = \$1.50/100Btu/day up to 1100kBtu/day for ShW
- special customer\* = \$1.25/Watt up to 10kW. \$3.00/100 Btu/day up to 1500 kBtu/day for ShW. \*\*Group net-metered projects are only eligible for residential customers with residential meters.
- PV and ShW Efficiency Adder - adder is calculated separately and added to standard incentive subject to customer caps (eligibility requirements apply, contact RERC)
- residential = \$0.15/Watt for PV; \$0.50/100Btu/day for ShW. Capped at a cumulative \$350, residential customers; \$450, commercial/industrial/special customer = \$0.15/W; \$0.50/100Btu/day up to a cumulative \$450 per customer

### Micro-Hydro

- residential/commercial/industrial - \$1.75/3'gal/minute Capped at \$8750
- special = \$3.50/3' gal/minute Capped at \$17500 or 50% of installed cost

*\*\*special customer category limited to municipalities, non-profit housing authorities, public schools. All incentives are subject to availability and may change.*

Visit [www.rerc-vt.org](http://www.rerc-vt.org)  
or call (877)888-7372

## 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. Any unused tax credit may not be carried forward.

## EFFICIENCY VERMONT

### Lighting (must be ENERGY STAR)

- CFLs - select ENERGY STAR qualified spiral and specialty CFLs are just 99¢ at participating retailers
- LED's – bulbs with special pricing/ coupons at register while supplies last at participating\* retailers

### Home Efficiency Improvements

- improvements: air sealing, insulation and heating system upgrades - up to \$2,100 in incentives - using participating\* contractors

### Appliances (must be ENERGY STAR)

- Dehumidifiers - \$25 mail-in rebate
- Clothes Washers - \$40 rebate for CEE

- Tier 3 qualifying models, \$75 rebate for ENERGY STAR Most Efficient
- Refrigerators - \$40 rebate for CEE Tier 2 Refrigerators, \$75 for CEE Tier 3 & ENERGY STAR Most Efficient
- Working second refrigerators or freezers are potentially eligible to be picked up. \$50 incentive to retire old units.
- Clothes Dryer –rebate for replace electric with natural gas (contact EV\*)

### Heating/Cooling

- heating & hot water systems – see EV\*
- energy efficient central AC and furnace fan motor - \$100 mail-in rebate
- central wood pellet boilers (excluding outside wood systems) - \$1,000 (See announcement on page 25)

### Residential New Construction

- enroll in Residential New Construction Service – up to \$1,500 in incentives and free home energy rating and expert technical assistance throughout construction and eligible for ENERGY STAR label
- Washington Electric Coop and Vermont Gas Systems customers may also receive additional incentives (contact EV\*)

### Other Opportunities To Save

- Advanced Power Strips – special pricing/ coupons at register at participating retailers\*
- Pool Pump (2-speed/variable speed) - \$200 mail-in rebate
- Meter Loan – borrow "Watts Up" meter to measure the electric consumption of your appliances

*\*all rebates/incentives subject to availability, limits and may change – for complete incentives and requirements, and for participating retailers/contractors, visit [efficiencyvermont.com](http://efficiencyvermont.com) or call 888-921-5990*

# NEW HAMPSHIRE

## Renewable Energy Incentives Offered Through the NH Public Utilities Commission Commercial Solar Rebate Program

Program open to non-profits, businesses, public entities and other non-residential entities

- Rebates for solar electric/thermal projects 100kW (or thermal equivalent) or less
  - Solar PV = \$0.80/Watt D/C up to \$50,000
  - Solar thermal = \$0.07(or\$0.12 per systems of 15 collectors or fewer) per thousand-Btu per year, up to \$50,000
- Contact [jack.ruderman@puc.nh.gov](mailto:jack.ruderman@puc.nh.gov)

## Commercial Bulk Fuel-Fed Wood Pellet Central Heating Systems

- 30% of the heating appliance(s) and installation cost, up to a maximum of \$50,000. An additional 30% up to a maximum \$5,000 is available for thermal storage. Systems must be 2.5 million BTU or less

## Residential Solar PV Rebate Program

- \$0.75/watt capped at \$3,750 per system, whichever is less. Systems must be under10kW. Subject to funding availability.
- Contact [jon.osgood@puc.nh.gov](mailto:jon.osgood@puc.nh.gov)

## Residential Solar Water Heating Rebate Program

- \$1500 - \$1900 per system based on annual system output
- Contact [barbara.bernstein@puc.nh.gov](mailto:barbara.bernstein@puc.nh.gov)

## Wood Pellet Boiler or Furnace

- 30% of installed system up to \$6k
  - Must meet thermal efficiency and particulate emissions standards
- Contact [barbara.bernstein@puc.nh.gov](mailto:barbara.bernstein@puc.nh.gov)  
[www.puc.nh.gov](http://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](http://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.

## Renewable Energy Incentives Offered Through the NH Electric Co-Op Commercial Renewable Energy

- is 25% of the project cost up to \$20,000.

### Residential Solar PV

- is 20% of the project cost up to \$2,500.

### Residential Solar Hot Water

- is 20% of the project cost up to \$1,500.

### Heat Pump Water Heaters

- is 50% of the project cost up to \$1,000.

### Heat Pump Conversion

- is 35% of the project cost up to \$10,000 for Geothermal Heat Pumps.
- is \$450-\$900 per system based on SEER rating for Ductless Mini-Split Heat Pumps.
- is 35% of the project cost up to \$3,500 based on SEER rating for High Efficiency & Hybrid Central Heat Pumps.
- is 35% of the project cost up to \$25,000 based on SEER ratings for Commercial ground or air source heat pumps and ERV's.

## PAREI

To explore the possibility of a solar installation. Plymouth Area Renewable Energy Initiative. [www.plymouthenergy.org](http://www.plymouthenergy.org)

## www.nhsaves.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/residential/retrofit.html](http://www.nhsaves.com/residential/retrofit.html) for more information and an online Home Heating Index calculator

## NH ENERGY STAR Homes

Incentives for builders of new homes who meet ENERGY STAR guidelines.

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



Incentives include HERS rating fee paid by the utility, rebates for ENERGY STAR lighting, appliances and heating systems, and \$800 - \$4,000 additional incentive depending on the HERS score.

Visit [www.nhsaves.com/residential/homes.html](http://www.nhsaves.com/residential/homes.html) for more details.

## NH ENERGY STAR Appliances & Lighting

Mail-in rebates for ENERGY STAR-rated clothes washers (\$30), room air conditioners (\$20), room air purifiers (\$15) and smart strips (\$10).

Visit [www.nhsaves.com/residential/es\\_appliance.html](http://www.nhsaves.com/residential/es_appliance.html) for more information and rebate forms.

Instant rebate coupons ranging from \$1 to \$7 for ENERGY STAR-rated CFL and LED light bulbs purchased through qualifying NH retailers.

Visit [www.nhsaves.com/residential/es\\_lighting.html](http://www.nhsaves.com/residential/es_lighting.html) for more information.

## nhsaves Lighting and Efficiency Catalog

Extensive catalog of efficient lighting products, from stylish lamps to hard to find specialty bulbs. Catalog includes other efficiency items such as smart strips, power monitors, and water-conserving devices.

Offered at discounted pricing for NH electric utility customers, and fulfilled by EFL.

Visit [catalog.nhsaves.com/](http://catalog.nhsaves.com/) for an online version of the catalog.

## 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/](http://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/](http://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 and Greenhouse Gas Emissions Reduction Fund (RGGI).

Visit [www.nh.gov/oep/programs/weatherization/index.htm](http://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, NSTAR, Unitil (Fitchburg Gas and Electric), WMCO or a participating Municipal Light Plant community.

- Residential Rebate: \$25/per collector X the SRCC thermal performance rating of the collectors (pls refer to kBtu/panel/day for Category C, Mildly Cloudy climates)
- Metrics for typical SHW system for 2-4 people, 2-panel roof-mounted plus 80 gal solar tank: materials/installation costs = \$10,000, MA CEC residential

rebate = \$2400 including • Adder for moderate home value or for moderate income. MA State Tax Credit (use only once) = \$1000, Federal Tax Credit (30% system cost) = \$3000, Net Cost = \$3600

Visit [www.masscec.com/index.cfm/page/Commonwealth-Solar-Hot-Water/cdid/1176/pid/11159#shwresources](http://www.masscec.com/index.cfm/page/Commonwealth-Solar-Hot-Water/cdid/1176/pid/11159#shwresources) Commercial Solar Hot Water rebate program info <http://www.masscec.com/solicitations/commonwealth-solar-hot-water-commercial-scale>

### 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 minus the MA CEC rebate. Apply through receiving the MassSave Energy Audit.

### 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: attic-wall-basement insulation, high efficiency heating systems, high efficiency domestic hot water systems, solar hot water systems, 7-day digital programmable thermostats, Energy Star replacement windows

Available only to utility customers of Western Mass Electric, National Grid, Berkshire Gas, Nstar, Unitil and Cape Light Compact Visit [www.masssave.com/residential/heating-and-cooling/offers/heat-loan-program](http://www.masssave.com/residential/heating-and-cooling/offers/heat-loan-program) Please call 866-527-7283 to schedule a free home energy assessment.

### Commonwealth Solar PV Programs

[www.masscec.com](http://www.masscec.com)

Commonwealth Solar II provides rebates for homeowners and businesses in Massachusetts who install solar photovoltaics (PV). Rebates are granted through a non-competitive application process for the installation of photovoltaic (PV) projects by professional, licensed contractors at residential, commercial, industrial, institutional and public facilities. In addition to the base incentive (.40/W), further incentives ("adders") are available for installations using components manufactured in Massachusetts (.05/W), for individuals with moderate income or home values (.40/W), and for those who are rebuilding in the wake of a natural disaster (1.00/W).

For all systems, rebates are calculated by multiplying the per watt incentive (base incentive plus adders) times the nameplate capacity of the system, up to 5 kilowatts (kW); projects are eligible for rebates only if their total capacity is under 15kW. Further eligibility requirements apply, and potential rebate recipients should read the full program documentation.

<http://www.masscec.com/solicitations/commonwealth-solar-ii-block-16>

### Dept of Energy Resources

- 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 program. Note: appropriate, approved tracking must be utilized in order to qualify to sell SRECs.
- 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 solar hw or pv systems.
- There is no increase in property tax assessment for residential hw or pv systems for 20 yrs.

# CARBON TAX: WHY IT IS NECESSARY, AND WHY IT IS FAIR

By George Harvey

The US EPA has estimated the social cost of letting carbon dioxide escape into the atmosphere at \$12 to \$116 per ton. Since this can be hard to understand, it may need an explanation.

The social costs of carbon emissions are all around us. Many of them can be seen in health problems requiring costly medical attention, such as asthma, respiratory distress, and a number of other health issues relating to fossil fuel pollution. Aside from health problems, there are also climate change, damage to property, ocean acidification, and a long list of other issues.

Many people find it hard to envision a ton of carbon dioxide. Burning a gallon of gasoline in a car engine releases about twenty pounds of carbon dioxide. This may defy logic for some people, because a gallon of gasoline weighs less than seven pounds, so they ask how it could produce twenty pounds of gas. In being burned, the carbon in the gasoline combines with oxygen from the air, and the oxygen provides almost three quarters of the weight of carbon dioxide. Because a gallon of gasoline produces twenty pounds of carbon dioxide, the \$12 to \$116 per ton social cost of carbon dioxide equates to \$0.12 to \$1.16 per gallon of gasoline.

The social cost of gasoline is not taxed or paid at the pump. Neither the oil industry nor the consumer is charged a fee. Nevertheless, each gallon of gas a person burns means doing \$0.12 to \$1.16 worth of damage. Other fossil fuels have their own costs, but they are similar or worse in effect.

Perhaps we could think of using fossil fuels as producing charges against a

Global Sickness Account. If a car gets twenty miles to a gallon of gas, it may be charging as much as 5.8¢ to the Global Sickness Account for each mile it goes, so some asthmatic kid has 5.8¢ more in medical bills, or a state has to fund forest stewardship with 5.8¢ to address extra damage.

Actually, the issue is worse than that. Fossil fuels spill a long list of pollutants into the air: sulfur compounds, nitrates, nitrites and radon. In the case of coal, the list also includes mercury, lead, and thorium. Here in New England, we have streams and rivers whose fish should not be eaten because they contain excessive mercury from coal-burning power plants in Ohio, Michigan, Pennsylvania, and other upwind states. We did not cause the pollution, but it is ours to deal with. In the case of mercury, we have no practical way even to do that, so it is likely to hang around for centuries.

And here is the place where we need to be fair: Fossil fuels create charges against the Global Sickness Account, but the costs are born entirely by victims, including many who do not benefit from fossil fuel use at all. Those who do not benefit include nearly all forms of wildlife and a large percentage of the world's poor. Fairness means those who created the cost are the ones who foot the bill, and the victims get some relief.

A carbon tax will help make the polluters bear their fair share of the costs. And it can help finance the cure.

As the February issue of Green Energy Times comes out mid-month, our legislators are meeting. Does anything come to mind? 🐼

## CONGRESS SHOULD PUT A PRICE ON CARBON POLLUTION

By Sen. Bernie Sanders (I-Vt.) and Sen. Barbara Boxer (D-Calif.)

More than 700 companies that drive the U.S. economy - including Microsoft, Owens Corning, General Motors, the Portland Trail Blazers and candymaker Mars - have signed a declaration calling for national action on climate change. This is a remarkable shift in how some of the nation's biggest corporations view the threat posed by climate change. Policymakers should take notice.

The nation's five biggest oil giants are among a smaller set of companies that had strongly resisted proposals to address climate change but now are incorporating its practical impact into their strategic planning. According to a new report by the environmental data company CDP, more than two dozen of the nation's leading corporations are planning for the future with the expectation that carbon emissions fees will be one of the steps the

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Coal-fired Gavin Power Plant on the Ohio River



# GEO THERMAL + SOLAR = EFFICIENCY

By George Harvey

When Don and Judy Jordan decided put build a house, they wanted to share it with Judy's parents, who are in their mid-80s. This meant addressing some unusual needs for warmth, as they had spent twenty years in Florida, and special consideration for potential special needs. Given four adults and a potential for visiting grandchildren, they allowed 3325 square feet of space. These issues meant making some careful choices on how to achieve efficiency and comfort without breaking the bank.

They contacted Prudent Living, a division of Biebel Builders, of Windsor, Vermont, to help them with the project. This choice gave them some guidance with some very technical issues.

They did not decide to be fancy and go for LEED certification, or even to be entirely free of fossil fuels. Nevertheless, they achieved some very impressive results, in terms of green performance, because they were trying to get comfort, warmth, and economy, goals that can be achieved through green means.

Insulation and sealing are, of course,

essential. Even if your heating is great, it does no good if you are using it to heat the great outdoors. R-60 insulation was specified for the ceiling, and above-grade walls were R-40 and R-30. Below grade walls were specified at R-20, with insulation under the slab at R-10. The house was buttoned up, and GDS Associates of Manchester, New Hampshire, tested for infiltration.

All told, the house would get a HERS Index of 42, if it were rated without consideration for renewable energy generating capacity. This means it uses only 42% of the energy needed to power a typical new house of the same size.

Given a good start on insulation and sealing, the Jordans went for a ground-source heat pump, or geothermal heat, to provide both house heating and hot water. This provides heat at just about the lowest possible price heating in a house that is not actually passive solar. It also makes possible use of the same equipment for cooling, as needed.

One result of the choice of ground-source heat pump is that the overall cost of heat has dropped below the cost of lighting. This is despite the fact that all

the lighting is Energy Star compliant.

Offsetting the electricity load, the Jordans opted to have solar PVs generating about 70% of the power they need. This reduces their HERS Index to 12, meaning that their net usage is only about 12% of what might be normally be expected. Adding in service charges and a very small amount of propane used for cooking and drying clothes, their cost for 2013 was estimated at less than \$1000 for all power and fuel, and their carbon emissions were a good deal less than half a ton.

The Jordans' house got a confirmed Energy Star certificate of «Five Stars+».



3325 s.f. of efficiency include geothermal & a super efficient building envelope. Photo credit Tim Biebel



We at Green Energy Times wish to congratulate the homeowners and Prudent Living on a great achievement. 🐾

18

Cyan  
Magenta  
Yellow  
Black

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## SAVE MONEY AND ENERGY WITH “SMART” THERMOSTATS

By Roddy Scheer and Doug Moss

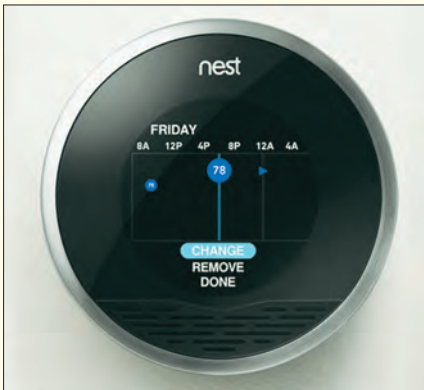
Spending \$200 or more to replace that older, still functioning thermostat with a new whiz-bang “smart” variety might seem like a waste of money, but it can be one of the best small investments a homeowner can make, given the potential for energy and cost savings down the line.

The coolest of the bunch of new smart thermostats, the Nest, was created by former Apple employees who had been instrumental in designing the original iPod and iPhone years earlier. This simple-looking round thermostat is reminiscent of old-school thermostats that one would manually adjust by turning the temperature dial. But the auto-awake feature that turns on the bright blue digital display when someone walks nearby gives the Nest away as an ultra-modern piece of high-tech gadgetry.

The Nest's software “learns” the habits in a given space by logging when inhabitants tend to be home and awake and noting when they tend to turn up or down the heat—and then sets a heating and cooling schedule accordingly. Owners can also program the Nest, which connects to the Internet via Wi-Fi, to heat or cool the house at a schedule or go into “away” mode from any web browser or smart phone.

While the Nest is likely the best known smart thermostat available—especially since Google acquired the company behind it in early 2014—several other manufacturers (including Honeywell, ecobee, Hunter, Radio Thermostat, Trane and Lux) have wi-fi-enabled smart thermostats available now as well.

While only some of them have the auto-sensing and learning capabilities of the Nest, those without that feature also cost less. And merely programming in a weekly schedule to any smart thermostat



Navigant Research reports that the number of smart thermostats in operation around the world will jump from 1.4 million currently installed to some 32 million by 2020. These kinds of numbers will help utilities meet or exceed energy efficiency goals regardless of other upgrades on their power plants. Photo Credit: The Nest

will be the main source of cost and energy savings. People who were diligent about turning their old thermostats up and down throughout the day might not see any substantial savings with a smart thermostat, but most of us aren't so diligent—especially when it comes to turning the heat down at night when we are sleeping.

Many smart thermostat owners report savings of between \$10 and \$30 per month on their heating and cooling bills—and research has shown that such an upgrade can save upwards of 10 percent of the total energy consumed by a given household. Smart thermostats range in price from \$50 to \$250, so upgrading could pay for itself within a year or two at most, with long-term savings racking up month-by-month after that.

Many utilities now offer free or dis-

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# WHAT IS THE DEAL WITH HEAT PUMPS?

By Richard Faesy, Energy Futures Group, Inc.

Heat pumps seem to be in the news recently. In April, Efficiency Vermont launched a new program promoting them and Green Mountain Power recently launched a heat pump rental program that appears to be wildly successful. They expected to hear from about 200 customers but instead received inquiries from more than 600. What's up?

Members of Building for Social Responsibility are intrigued with the technology and are excited to see heat pumps designed for Vermont's climate now available at reasonable costs. Besides biomass, we now have a fossil fuel alternative that can automatically heat (and cool) our homes at about half the operating cost of oil or propane. And since heat pumps run off electricity, we can now deliver zero net-energy heating and cooling systems by adding PV panels to offset the heat pump

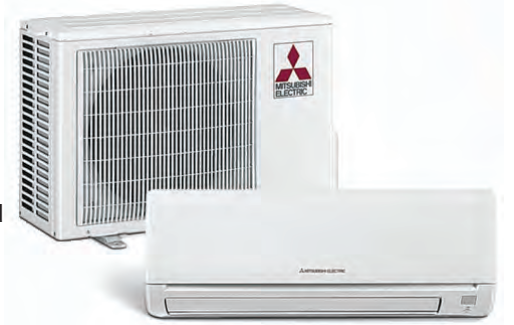
load. If all this is so good, what's the catch? Is this another one of those too-good-to-be-true technologies that will be gone after an initial flash in the pan?

Actually, heat pumps have been around for decades and are the primary means of heating and cooling buildings in most of the world outside of North America. The technology is the same as that used in refrigerators to concentrate heat and move it from one place to another. With a refrigerator, it works to gather up the heat in the food storage area and then dump it into the kitchen. With today's heat pumps, in winter they concentrate heat from outside (even in temperatures below 15 degrees below zero) and then deliver it inside. In the summer they do the opposite to cool the building by moving heat from inside to outside.

While we have been installing "ground-source" heat pumps in the Northeast

for decades that are able to move heat between buildings and the ground (or water wells within the ground), they tend to be pricey, typically \$20,000 to \$40,000 installed. The new "air-source" heat pumps do not require drilling expensive wells or digging long trenches like those that are necessary for the ground-source units, and can be installed for about \$4,000 per unit for those systems that work in Vermont's cold climate. These "cold-climate air-source" heat pumps can provide up to about 20,000 Btu per hour, so you would typically need a few systems for a well-insulated tight Vermont house, provided the layout works to allow heat distribution. For two systems, that's \$8,000; not bad for a heating and cooling system that cuts oil bills in half!

If you want to know more about which units work best in Vermont's winters and what incentives are available for install-



ing cold climate heat pumps in existing homes to displace oil and propane, take a look at [http://www.efficiencyvermont.com/for\\_my\\_home/ways-to-save-and-rebates/energy\\_improvements\\_for\\_your\\_home/Cold-climate-heat-pump/overview.aspx](http://www.efficiencyvermont.com/for_my_home/ways-to-save-and-rebates/energy_improvements_for_your_home/Cold-climate-heat-pump/overview.aspx).

Richard Faesy is Co-founder and Principal of Energy Futures Group, Inc. [www.energyfuturesgroup.com](http://www.energyfuturesgroup.com)

## "SMART" THERMOSTATS

Cont. from page 18

counted smart thermostats to customers. Getting in on such a program is a great way to reduce energy costs without the up-front expense of installing a smart thermostat independently. According to the Database of State Incentives for Renewables and Efficiency (DSIRE), incentives to install smart thermostats are available through utilities in 45 states. New York's Con Edison, California's PG&E and Texas' CPS Energy are just a few of the larger utilities offering such incentives.

Those that do upgrade certainly won't be

alone. Navigant Research reports that the number of smart thermostats in operation around the world will jump from 1.4 million currently installed to some 32 million by 2020. These kinds of numbers will help utilities meet or exceed energy efficiency goals regardless of other upgrades on the power-plant side of their businesses. Likewise, the efficiency boost also can play a key role in reducing our reliance on fossil fuels and our emissions of greenhouse gases.

Contacts: Nest, [www.nest.com](http://www.nest.com); DSIRE, [www.dsireusa.org](http://www.dsireusa.org); Navigant, [www.navigantresearch.com](http://www.navigantresearch.com).

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# Sustainable Sugaring



Solar Sweet Maple created a warm and inviting space where visitors sit at the farmer's table for some refreshments -- a perfect way to spend a spring afternoon

## Suggested uses for Maple Syrup

- Use on cereal instead of sugar
- Sweetener for yogurt over fruit
- As a topping for ice cream
- Sweetener for coffee or tea
- Added to stir fry or sweet & sour dishes
- Excellent as sweetener in baked goods
- Nice addition for baked winter squash

## Solar Sweet Maple Farm

Tom Gadhue had a vision, and it produced his motto, "A green twist on an old Vermont tradition". He wanted to make maple syrup, and he wanted the farm to have the smallest environmental impact possible. So he and his wife, Rhonda built Solar Sweet Maple Farm to be as sustainable as possible.

He started building his sugarhouse by salvaging the frame of a glassblower's studio. The siding was also salvaged from three area barns. The building was insulated with panels, four inches thick. The sugarhouse with a large, south-facing roof, so it could hold as many solar PVs as possible. His 12.5kW array is net-metered, so he can bank electricity credits in the summer for use in the winter.

Tom chose a number of energy-saving features as well. The lighting is all done with LEDs. The reverse-osmosis machinery he has removes 80% of the water before the sap is heated, and it is solar-powered. Vacuum pumps pull sap to the building, also powered by the sun. The evaporator

is fueled with wood from his own woodlot. So is the hot water and heat for buildings.

The evaporator is powered by wood, but with a new twist. It has a wood gasification system that starts with a fire beneath the evaporator, captures unburned flu gasses, then adds fresh air to finish burning them, heating the evaporator more. This results in a burn that is as nearly complete and non-polluting as possible.

Heat is reclaimed from the steam as the sap boils. It is used to preheat sap for the evaporator. Tom estimates a reduction in the amount of wood needed to boil the sap of over 70%.

Solar Sweet Maple Farm has a line of maple products including four different grades of syrup, samples and gift items, maple cream, maple walnuts, and maple balsamic dressing.

The farm is located at 3841 South Lincoln Road Lincoln, Vermont. Their number is 802-453-6063 and the website is [solarsweetmaplefarm.com](http://solarsweetmaplefarm.com).



Solar Sweet Maple Syrup is made in a 5x14 D&G wood-fired gasification evaporator. The wood is harvested from their sugar woods and is used to heat the evaporator and the sugarhouse.

## Silloway Maple Farm

Silloway Maple, in Randolph Center Vermont, really does date back to the times of Norman Rockwell. Paul Silloway started it as a dairy farm in 1940 and expanded into maple sugaring in 1942. In those days firewood and sap were gathered with a team of horses, and no fossil fuels were used at all.

Today, the maple operation is managed by Paul Lambert, Paul Silloway's grandson, with his mother Bette, and David, Lynne, Stuart, and John

Silloway. The firewood for the evaporator comes from logging waste, but the amount needed is also reduced from what it was in the old days. Most of the water in the sap is removed before it is even heated up by using reverse osmosis. The reverse osmosis is powered by sunlight from the farm's solar PV array.

Recently, the farm needed a new building for sugaring. Paul and Bette Lambert decided to put 17.5kW of solar PVs on its roof. The solar system was installed by Integrity LLC of Bethel, Vermont. This provides power for the farm's maple sugaring with excess going towards the dairy production. The system is grid-tied and net-metered, so summer production helps with winter usage.



TOP: Silloway Maple's 17.5kW solar pv system atop the roof of their new sugar house.

BOTTOM: Inverters and electronics inside of the new sugaring building at Silloway Maple

When the Vermont Agency of Agriculture started a voluntary sugarhouse certification program, Silloway quickly joined in to get one more seal of approval, cleanliness, and safety.

The farm has about 6100 maple trees and the owners hope to produce 3100 gallons of pure maple syrup. In addition to syrup, they produce maple cream and maple walnuts, peanuts and almonds. Their products are sold at the farm, in retail stores, and through their website. They also have a working dairy with 65 milking Holsteins. They do logging, and sell firewood.

Bette Lambert asked that we remind everyone that the Vermont Maple Open house Weekend is March 22 and 23. Silloway Maple Farm will, of course, be participating. She said they will offer maple sugar on snow and homemade doughnuts with syrup. How could anyone pass that by?

Silloway Maple Farm is at 1033 Boudro Road, Randolph Center, Vermont. Their number is 802-728-3625.



**Ben's Sugar Shack** 83 Webster Hwy, Temple, NH 03458 and 693 Rt 103, Newbury NH • (603) 562-6595

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## Guidelines For Cooking with Maple Syrup

To replace sugar with maple syrup in your baking, use 3/4 cup of syrup for every cup of sugar, and decrease the total amount of liquid in the recipe by about 3 Tbl for each cup of syrup you use.

- Maple syrup is slightly acidic so you may want to add 1/4 to 1/2 tablespoon of baking soda. This is not necessary if you are using recipes with buttermilk, sour cream or milk.
- To replace honey with maple syrup, use the same quantity of syrup instead of honey.
- Reduce the oven temperature by 25°. Maple syrup can cause more browning than sugar.





In earlier times, Shaker communities were divided into groups called families, often named after compass points. The North Family Maple Farm occupies land of the Shaker community in Canterbury, New Hampshire, settled in 1792.

The farm has been a family-run business since 1950. Today, it is run by Tim, Daimon, and Gemini Meeh and Jill McCullough. In 2011, they won an award as New Hampshire's outstanding tree farm for 50 years of sustainable forest management.

Starting as a dairy farm, in 1959, it became a school, which eventually moved to its own campus. Farming started again in 1974, and since then, the farm has produced a variety of products. It has had a small retail Jersey dairy, and bred and trained Percheron horses. It has had grain crops, and organic vegetables. It has sold milling lumber.

Now, the farm sells hay, firewood,

timber, and maple products, all grown with an eye to sustainability. It has a small wind turbine and 7kW of owner-installed solar PVs. It uses biodiesel and sustainably grown wood for fuel. Unsurprisingly, their maple product is New Hampshire Certified Organic Maple Syrup.

The farm uses reverse osmosis to concentrate the sap. Then a gasification system evaporator removes most of the remaining water. This reduces the amount of firewood needed by 87%.

Their website also provides some very interesting information on the health benefits of maple syrup, including its effectiveness against diabetes and certain common types of cancer. There are links to information sources.

The maple products include maple syrup in various sizes and container types, maple cream, and maple sugar.

North Family Farm is in Canterbury, New Hampshire. The number is 603-783-4712, and the website is northfamilyfarm.com.



Wind, Solar PV & Solar Hot Water at the North Family Maple Farm, Tim Meeh, fueling up with biodiesel, Jill McCullough Loading the firewood truck

## PEANUT BUTTER MAPLE COOKIES

Courtesy of vermontmaple.org

Yields 16 to 24 cookies, depending on size.

- 1/2 cup of butter softened (1 stick)
- 3/4 cup pure Vermont maple syrup
- 1 teaspoon vanilla extract
- 1 egg
- 1 cup peanut butter, preferably natural chunky peanut butter
- 1-3/4 cups flour
- 1/2 teaspoon salt
- 1/2 teaspoon baking soda



Preheat oven to 375°F. Using mixer, combine butter and syrup until well-mixed and creamy. Add vanilla extract, egg, and peanut butter and beat until well-mixed and creamy.

In a separate bowl, combine flour, salt, and baking soda. Add dry ingredients to the peanut butter mixture in several additions, mixing well before adding more.

Roll tablespoons of the dough into a ball and place on an ungreased baking sheet. At this point, if you prefer peanut butter cookies with the a crosshatch pattern, press cookies with a fork to create crosshatch. Bake for 15 minutes and let cool on the sheet for several minutes before transferring to a rack to completely cool. Serve and enjoy!

## RECOMMENDED READING:

### The Sugarmaker's Companion An Integrated Approach to Producing Syrup from Maple, Birch, and Walnut Trees

by Michael Farrell, 344 pages, Chelsea Green Publishing, \$39.95

The Sugarmaker's Companion is the comprehensive guide syrup producers have been waiting for. Many unique aspects of this book set it apart from all others. These include sustainable production; health benefits; certification, registration, and grading systems; understory crops; forestry; economics; marketing; business models; and more.

This book is applicable to a wide range of climates and regions, and is sure to prove invaluable for both home-scale and commercial sugarmakers. This is a unique guide to making an integrated sugaring operation, interconnected to the whole-farm system, woodland, and community.

### Maple Sugarin' in Vermont - A Sweet History

by Betty Ann Lockhart, 192 pages, 90 illustrations, The History Press, \$19.99

Relating the history of the "Flavor of Vermont" from the 1600s to the mid-twentieth century, Betty Ann Lockhart introduces readers to the tools of the sugaring trade and the personalities who launched maple sugar to world fame. The Abenakis discovered it, and Thomas Jefferson was an early promoter of its virtues. During the Civil War, maple sugar was cheered as the moral alternative to cane sugar, which was produced by slave labor. Enriched with maple-inspired songs, recipes and legends, Maple Sugarin' in Vermont illuminates the culture of Vermont maple sugar.

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## DID YOU KNOW?

vermontmaple.org

Maple syrup contains an abundant amount of naturally occurring minerals such as calcium, manganese, potassium and magnesium. And like broccoli and bananas, it's a natural source of beneficial antioxidants.

Antioxidants have been shown to help prevent cancer, support the immune system, lower blood pressure and slow the effects of aging. Maple syrup is also a better source of some nutrients than apples, eggs or bread. It's more nutritious than all other common sweeteners, contains one of the lowest calorie levels, and has been shown to have healthful glycemic qualities.

Maple syrup was the original natural sweetener. Native peoples in North America were the first to recognize 100% pure maple syrup as a source of nutrition and energy. Since then, researchers have been documenting that maple syrup has a higher nutritional value than all other common sweeteners. In addition, researchers have found that pure maple syrup contains numerous phenolic compounds, commonly found in plants and in agricultural products such as blueberries, tea, red wine and flax-seed. Some of these compounds may benefit human health in significant ways.

So go ahead and satisfy that sweet tooth with something that not only tastes great...but is naturally good FOR you!

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NUTRITIONAL VALUE FOR VARIOUS SWEETENERS					
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Riboflavin	37	1	2	0	1
Zinc	6	0	2	0	0
Magnesium	7	0	1	2	0
Calcium	5	0	0	4	0
Potassium	5	0	1	1	0
Calories	216	220	261	216	196
SOURCE: Canadian Nutrient File, 2007 (Health Canada) and US Food and Drug Administration Nutrient Database					



# METHANE

By George Harvey

Methane is a powerful greenhouse gas, more than twenty times as bad as carbon dioxide. It also stays in the atmosphere for a long time, once released. This means it is better to burn it, even if no benefit is derived from the heat, than to let it go into the air as it is.

Nevertheless, methane has many uses, and that can make it valuable. It is the main constituent in natural gas, which is rapidly replacing the coal used in the United States. Since methane is much cleaner and releases less carbon dioxide than coal per unit of energy produced, it provides some improvement. This does mean it is perfect, just that it is better than coal. Also, we have to bear in mind that some natural gas comes from fracking, which may have very bad side effects.

Methane can be derived from sources other than natural gas. It is produced when bacteria break down cellulose, which is found in the cell walls of plants and makes up about a third of the weight of wood or straw. Since methane from such sources has carbon atoms that were recently part of the atmosphere, burning them and releasing the carbon dioxide they produce back to the atmosphere is considered carbon-neutral.

The bacteria that make methane are ubiquitous. They live in the stomachs of cattle, assisting their digestion, but making them belch enough to be a major source of greenhouse gasses.

The bacteria also work on materials in landfills, where they decompose such biomass as waste food, waste paper, and wood. This is why it is very important that landfills be covered to capture the gas coming out. The methane captured this way is used as fuel – or if there is not enough of it for such use, it is burned so carbon dioxide is released instead of methane.

The same kinds of bacteria live in biodigesters, where they decompose agricultural and food waste, or even municipal waste, to produce biogas. Biomethane is usually burned for energy and heat. It turns out to be one of the least expensive sources of electricity we have right now.

Methane can also be synthesized. It is relatively easy to capture carbon dioxide from the emissions of natural gas power plants, and only a bit more difficult to capture it from coal-burning plants. Meanwhile, excess power on the grid, which can be purchased at very low wholesale prices, can be used to make hydrogen. The carbon dioxide and the hydrogen can be combined with catalysis. This requires some heat, which can be captured as waste heat from the power plants, and

some pressure, for which we can use more of the low-cost excess power.

Once we use low-priced power to synthesize methane, it is easy to store for use at peak demand times, when the price of power is high. Though the efficiency of the process is lower than that of just using natural gas, it can be more profitable and less polluting than using natural gas all the time.

The process of making methane from carbon dioxide was invented in 1913. It has not been used much as it is expensive compared to the cheap oil that was available in the 20th century. Now, when power is more costly, it is being tested commercially as a power source.

Methane can also be used as a feed-stock for the production a number of important chemicals. A process dating to the 1930s can catalyze methane into any of a

variety of chemicals, including propane, butane, octane, and so on. Gasoline, diesel oil, and home heating oil can be made in this way.

One set of products methane can be used to make is plastics. The plastics can be nearly identical drop-in replacements for such materials as polypropylene, polyethylene, or polystyrene. They can be made to be recycled or biodegradable.

Ultimately, there are two important questions about a supply of methane. First, is it a fossil fuel, or does it come from biological activity that removes carbon from the air? Second, is it released as methane, or as some relatively benign product? If it comes from the ground, it will be a greenhouse gas. If it comes from the air, it can have an effect that is neutral at worst, or possibly even beneficial. ♡



Farm biogas installation near Neuerkerode, Lower Saxony, Germany. Photo by Elmschrat.

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# LOW ENERGY VENTILATION

GET Staff

With a goal for energy efficiency, buildings for our future have very low levels of air leakage, so mechanical ventilation is usually essential. There are three basic ventilation strategies—natural ventilation, spot ventilation, and whole-house ventilation.

## Natural Ventilation

Natural ventilation is the uncontrolled air movement in and out of the cracks and small holes in a home. In the past, this air leakage usually diluted air pollutants enough to maintain adequate indoor air quality. Today, after a home is properly air sealed, ventilation is necessary to maintain a healthy and comfortable indoor environment. Opening windows and doors provide natural ventilation, but many people keep their homes closed up because they use central heating and cooling systems year-round.

Natural ventilation is unpredictable and uncontrollable—you can't rely on it to ventilate a house uniformly. Natural ventilation depends on a home's airtightness, outdoor temperatures, wind, and other factors. During mild weather, some homes may lack sufficient natural ventilation for pollutant removal. During windy or extreme weather, a home that hasn't been air sealed properly will be drafty, uncomfortable, and expensive to heat and cool.

## Spot Ventilation

Spot ventilation can improve the effectiveness of natural and whole-house ventilation by removing indoor air pollution and/or moisture at its source. Spot ventilation includes the use of localized exhaust fans, such as those used



TOP: Controlling moisture can make your home more energy-efficient, less costly to heat and cool, and more comfortable. RIGHT: Delta BreezGreenBuilder Ventilation Fan/LED Light Combo (GBR80LED) is a low noise ceiling mount ventilating fan rated for continuous running. Fan is ENERGY STAR® qualified, HVI, UL, and cUL certified, and can be used to comply with ASHRAE 62.2, CA Title 24, and CALGreen requirements.



above kitchen ranges and in bathrooms. ASHRAE recommends intermittent or continuous ventilation rates for bathrooms of 50 or 20 cubic feet per minute and kitchens of 100 or 25 cubic feet per

minute, respectively.

## Whole-House Ventilation

The decision to use whole-house ventilation is typically motivated by concerns

that natural ventilation won't provide adequate air quality, even with source control by spot ventilation. Whole-house ventilation systems provide controlled, uniform ventilation throughout a house. These systems use one or more fans and duct systems to exhaust stale air and/or supply fresh air to the house.

There are four types of systems:

**Exhaust ventilation systems** work by depressurizing the building and are relatively simple and inexpensive to install.

**Supply ventilation systems** work by pressurizing the building, and are also relatively simple and inexpensive to install.

**Balanced ventilation systems**, if properly designed and installed, neither pressurize nor depressurize a house. Rather, they introduce and exhaust approximately equal quantities of fresh

Cont. on page 30

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# BUTTON UP NH

## WEATHERIZATION WORKSHOP IS COMING TO PLAINFIELD ELEMENTARY SCHOOL, MERIDEN, NH

On Wednesday, February 19, 2014, the Plainfield Energy Committee will co-sponsor a BUTTON-UP weatherization workshop -- at the Plainfield Elementary School

on Bonner Rd. in Meriden, NH.

Participants will learn how to undertake basic air-sealing, insulation and conservation measures to reduce fuel and electricity consumption.

Attendees will also learn about the Home Performance with Energy Star (HPwES) program run by the state's electric utility companies. HPwES is open to all NH families, based solely on whether your home has a higher than average heating fuel bill. By signing up for the HPwES program, NH residents can access a Home Energy Audit for \$100, financial incentives up to \$4000 and technical expertise.

According to SERG's Bob Walker, "All NH residents who qualify should sign up for the Home Performance with Energy Star Program. It provides the financial and technical assistance to help homeowners save energy, save money and increase home comfort."

This workshop is being funded by Liberty Utilities, NH Electric Coop, PSNH and Unilil and is sponsored by Plymouth

Area Renewable Energy Initiative (PAREI) of Plymouth, NH, the Plainfield Energy Committee, Kimball Union Academy, the Plainfield Elementary School and Sustainable Energy Resource Group.

Agenda: 6:00-6:30 Registration, refreshments, energy efficiency information displays; 6:30-8:00 Residential BUTTON-UP Workshop by Bob Walker, SERG.

Registration is encouraged but not required. To register, go to [www.buttonup-plainfield.eventbrite.com](http://www.buttonup-plainfield.eventbrite.com).

Button Up NH Workshops are free and open to the general public. For more information on dates and locations for upcoming workshops visit: <http://www.myenergyplan.net/buttonup>.

If interested in hosting a Button Up NH Workshop in your community, e-mail Zak Brohinsky, [zak@plymouthenergy.org](mailto:zak@plymouthenergy.org), 603-536-5030 OR Michael O'Leary, [mol03766@tds.net](mailto:mol03766@tds.net), 603 469-3233.

The Button Up NH program also includes over a dozen mini energy videos to help NH residents start learning right now about home energy issues and savings. These videos can be viewed by going to the Button Up Videos link on the home page of [www.plymouthenergy.org](http://www.plymouthenergy.org).

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## VIEW FROM THE TOP

24 *Cont. from page 3*

farmland to promote continued use of the automobile -- but deployed wisely, biofuels have the potential to be a key part of our energy plan, both in the near future and more long-term. Infrastructure investment will be required to move toward the combined-heat-and-power model.

Hydro. The State of Vermont lost the chance in 2005 to purchase the large hydro dams on the Connecticut River -- those are now owned by out-of-state interests selling the power to markets to the south, and cannot be counted toward Vermont's hydropower production. That said, we still have the near-term potential of about 4 MWavg, or 10 MW of new hydropower capacity. This new capacity would be realized as electricity- production increases gained by upgrading existing hydro facilities, and also by installing new run-of-the-river, low-head hydro generation. There are hundreds of old, abandoned small dam sites in Vermont that can be brought back to life. New low-impact, fish-friendly technologies such as the Archimedes Screw hydro turbine could bring online 2MW of water power. However, in order for this to happen, the Vermont Agency of Natural Resources will need to standardize requirements and streamline permitting for small hydro. A process that currently takes many years should ideally take months.

Time is critical. The year 2020 is not as far off as it sounds. We must move a lot more quickly than we have to date in order to implement clean energy solutions that will benefit everyone in Vermont, and leave the state well-positioned to weather future instabilities in fossil-fuel energy sources. Let's put a price on carbon, and put the funds generated from a carbon tax into renewable energy investments now.

\*REV's guide to 20% by 2020:

<http://www.revermont.org/main/wp-content/uploads/REV-20-By-2020.pdf>

\*\*MWaverage is the average continuous production of power.

David Blittersdorf is the President/CEO of AllEarth Renewables in Williston, VT -- a company that specializes in the design and manufacture of the grid-connected AllSun Tracker solar energy system. He founded NRG Systems in Hinesburg, VT, and is the managing partner of Georgia Mountain Community Wind. ♪

## STATE DEPT. TURNS A BLIND EYE TO UGLY REALITY OF TAR SANDS

"The State Department study turns a blind eye to the ugly reality that extracting and refining dirty tar sands oil will spew into our atmosphere more and more of the greenhouse gases that cause global warming. To my mind, global warming is the most serious environmental crisis facing the world today and President Obama should block construction of the Keystone pipeline."

— Vermont Senator Bernie Sanders, 1/31/2014

## NEW TV SHOW ABOUT ENERGY

A new TV show, "Energy Week with George Harvey and Tom Finnell," is being shown on BCTV in the Brattleboro area, and it is available to be seen on any public access television station that wants to use it. It can also be seen on streaming video at the Green Energy Times website, [www.greenenergytimes.net](http://www.greenenergytimes.net).

In each show, George and Tom talk about the news of the week. The plan is that guests will appear regularly, and the people who have said they would like to attend make up a promising list. You are all invited to watch. ♪

## CONGRESS SHOULD PUT A PRICE ON CARBON POLLUTION

*Cont. from page 17*

federal government will take to address climate change. In other words, some of the very companies that have strongly opposed action to address climate change are recognizing that carbon pricing - a fee based on the amount of carbon pollution that some sources of energy release into our air - is likely.

The goals of carbon pricing include curbing our fossil fuel use, encouraging lower carbon emissions, creating jobs and spurring innovation. Cutting carbon pollution will help keep our air and water clean and protect our children from respiratory illnesses such as asthma. It also will help families and businesses across America save money.

There is a growing consensus that putting a price on carbon pollution is the most effective way to fight global warming. Pricing carbon has been endorsed by people across the political spectrum, including prominent conservatives George Shultz, Nobel laureate economist Gary Becker and Mitt Romney's former economic adviser Gregory Mankiw.

The scientific community is virtually united in saying that global warming poses an enormous threat and that it is caused largely by human activity. The insurance industry, which views the costs of climate change in starkly economic terms, also has weighed in. Munich Re, the

## NEWS, CLUES & BOOK REVIEWS!

## "NEWS PROGRAMS HAVE DEVOTED ALL OF EIGHT MINUTES TO DISCUSSING CLIMATE CHANGE IN 2012"

### Sanders Joins New Climate Action Task Force, Asks Why Network Sunday Shows Ignore Global Warming

On January 14, 2014, at a Capitol Hill news conference, Sen. Bernie Sanders (I-Vt.) and 15 other senators, announced the formation of a task force on climate change.

The first action by Senate Climate Action Task Force members will be to question why television network Sunday news programs have virtually ignored the issue of climate change. Sanders and Sen. Brian Schatz (D-Hawaii) are taking the lead on the issue.

A study by Media Matters for America reported that throughout 2012 the network programs devoted a total of 8

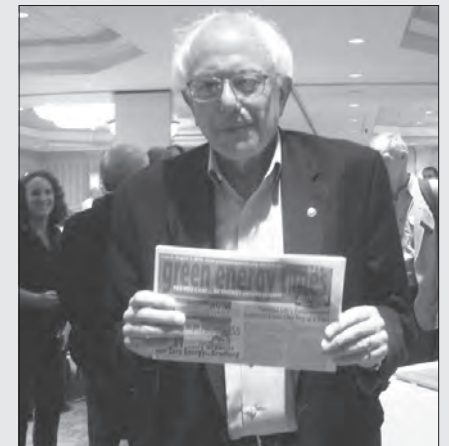
minutes to the issue of climate change.

"We have the scientific community telling us that climate change is the greatest crisis facing our planet and the major networks on their Sunday news shows have devoted all of 8 minutes to discussing that issue," Sanders said at the news conference.

"When I go back to Vermont people ask me what world the United States Congress is living in?" said Sanders. "They understand that the overwhelming majority of scientists agree that climate change is real, it is caused by human activity and it is causing devastating damage all over the world."

Sanders is a member of the Environment and Public Works Committee as well as the Energy and Natural Resources Committee. ♪

**Clean Technica took a look at peer-reviewed articles on climate change in scientific journals, from November 12, 2012 to December 31, 2013. They found 2,258 articles written by a total of 9,136 authors. Only one article, by a single author, rejected man-made global warming.**



largest reinsurance company in the world, calculated that the cost of damages from natural catastrophes in the United States exceeded \$139 billion in 2012 alone. "Climate change," they report, "represents a threat to our business."

National security experts, including the top American military officer in charge of Pacific security, Navy Adm. Samuel J. Locklear III, have identified climate change as the largest long-term security threat to the Pacific region. As sea levels rise and food production is severely undermined by climate disruption, potentially millions of people could be displaced, conflicts over resources will be amplified, and entire regions of the globe will become destabilized.

To address this global crisis, we introduced the Climate Protection Act. Our bill would establish a fee on each ton of carbon pollution emitted from the fossil fuel we produce and import. It would return 60 percent of the revenue directly to taxpayers.

The act would use the remaining revenue to support sustainable energy research, weatherize homes, help businesses save money through energy efficiency, grow the economy, and reduce the deficit. Our bill would reverse carbon pollution and help create millions of jobs as we transform our energy system away from fossil fuel and toward energy efficiency and sustainable energies like wind, solar and geothermal.

"This policy framework would protect

our economic growth while protecting vulnerable consumers by putting money right back in their pockets," Public Citizen's Tyson Slocum noted. "It rewards those who use less energy at home, and it invests in retrofitting and preparing the homes and communities most vulnerable to violent weather and high energy costs."

In addition to calling for action on climate change, many of the nation's largest corporations are incorporating carbon pricing into their strategic planning, including Microsoft, General Electric, Walt Disney, ConAgra Foods, Wells Fargo, DuPont, Duke Energy, Google, Delta Air Lines, ExxonMobil, ConocoPhillips, Chevron, BP and Shell. ExxonMobil expects that carbon pollution eventually will be priced at about \$60 a ton, three times more than our bill proposes.

Climate change is the single greatest threat to our country and our planet, and future generations will look back to this moment and judge us by the decisions we make today. The scientific community, those responsible for protecting our national security, the American public and corporations increasingly are recognizing that climate change is happening now and that carbon pricing is likely to be part of the solution. It is time for Congress to act.

Sens. Barbara Boxer, D-Calif., is chairwoman of the Senate Environment and Public Works Committee and Sen. Bernie Sanders, an independent from Vermont, is a member of the environment and energy committees. ♪



# ENERGY-EFFICIENT WINDOWS, PART 1

Energy-efficient windows provide space heating and lighting to this sunny kitchen. [Ask Loewen for pic]

The windows in your house let in light and air if they're operable, but they can also be weak spots in your home's thermal envelope.

When replacing windows, purchase the most energy-efficient windows you can afford, because they will pay for themselves over their lifetimes.

Windows provide our homes with light, warmth, and ventilation, but they can also negatively impact a home's energy efficiency. You can reduce energy costs by installing energy-efficient windows in your home. If your budget is tight, energy efficiency improvements to existing windows can also help.

## Improving the Energy Efficiency of Existing Windows

You can improve the energy efficiency of existing windows by adding storm windows, caulking and weatherstripping, and using window treatments or coverings.

Adding storm windows can reduce

air leakage and improve comfort. Caulking and weatherstripping can reduce air leakage around windows. Use caulk for stationary cracks, gaps, or joints less than one-quarter-inch wide, and weatherstripping for building components that move, such as doors and operable windows. Window treatments or coverings can reduce heat loss in the winter and heat gain in the summer. Most window treatments, however, aren't effective at reducing air leakage or infiltration.

## Selecting New Energy-Efficient Windows

If your home has very old and/or inefficient windows, it might be more cost-effective to replace them than to try to improve their energy efficiency. New, energy-efficient windows eventually pay for themselves through lower heating and cooling costs, and sometimes even lighting costs.

When properly selected and installed, energy-efficient windows can help minimize your heating, cooling, and lighting costs. Improving window performance in your home involves design, selection, and installation.

## Design

Before selecting new windows for your home, determine what types of windows will work best and where to improve your home's energy efficiency. ENERGY STAR® has established minimum energy performance rating criteria by climate. However, these criteria don't account for a home's design, such as window orientation.

Windows are an important element in passive solar home design, which uses solar energy at the site to provide heating, cooling, and lighting for a house. Passive solar design strategies vary by building location and regional climate,

but the basic window guidelines remain the same—select, orient, and size glass to maximize solar heat gain in winter and minimize it in summer.

In heating-dominated climates, major glazing areas should generally face south to collect solar heat during the winter when the sun is low in the sky. In the summer, when the sun is high overhead, overhangs or other shading devices prevent excessive heat gain.

To be effective, south-facing windows should have a solar heat gain coefficient (SHGC) of greater than 0.6 to maximize solar heat gain during the winter, a U-factor of 0.35 or less to reduce conductive heat transfer, and a high visible transmittance (VT) for good visible light transfer.

Windows on east, west, and north-facing walls should be minimized while still allowing for adequate daylight. It is difficult to control heat and light through east and west-facing windows when the sun is low in the sky, and these windows should have a low SHGC and/or be shaded. North-facing windows collect

little solar heat, so they are used only for lighting. Low-emissivity (low-e) window glazing can help control solar heat gain and loss in heating climates.

If you're constructing a new home or doing some major remodeling, you should also take advantage of the opportunity to incorporate your window design and selection as an integral part of your whole-house design—an approach for building an energy-efficient home.

### Selection

When selecting windows for energy efficiency, it's important to first consider their energy performance ratings in relation to your climate and your home's design.

This will help narrow your selection.

A window's energy efficiency is dependent upon all of its components. Window frames conduct heat, contributing to a window's overall energy efficiency, particularly its U-factor. Glazing or glass technologies have become very sophisticated, and designers often specify different types of glazing or glass for different windows, based on orientation, climate, building design, etc.

Another important consideration is how the windows operate, because some operating types have lower air leakage rates than others, which will improve your home's energy efficiency. Traditional operating types include:

**Awning.** Hinged at the top and open outward. Because the sash closes by pressing against the frame, they generally have lower air leakage rates than sliding windows.

**Casement.** Hinged at the sides. Like awning windows, they generally have lower air leakage rates than sliding windows because the sash closes by pressing against the frame.

**Fixed.** Fixed panes that don't open. When installed properly they're airtight, but are not suitable in places where window ventilation is desired.

**Hopper.** Hinged at the bottom and open inward. Like both awning and

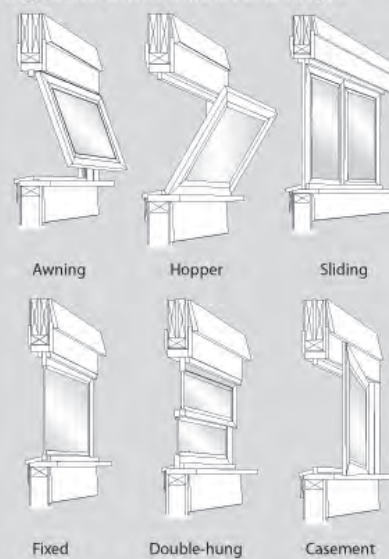
casement, they generally have lower air leakage rates because the sash closes by pressing against the frame.

**Single- and double-hung.** Both sashes slide vertically in a double-hung window. Only the bottom sash slides upward in a single-hung window. These sliding windows generally have higher air leakage rates than projecting or hinged windows.

**Single- and double-sliding.** Both sashes slide horizontally in a double-sliding window. Only one sash slides in a single-sliding window. Like single- and double-hung windows, they generally

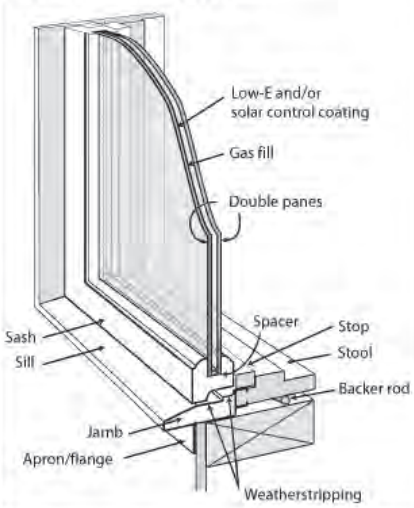
### Window Types

Energy-efficient windows come in traditional styles.



### Window Technologies

Energy-efficient window technologies are available to produce windows with the U-factor, SHGC, and VT properties needed for any application.



## ROCK WOOL

By George Harvey

When rock wool was invented in the 1840's no one was especially interested. It was re-introduced in the 1870's, but mostly passed from use. Now it is being brought back to market, with a new set of "green" credentials, and people who understand it are paying attention.

Rock wool, also called mineral wool or stone wool, is a man-made product. It is spun from various sources, including rocks and slag. It is similar to the fiberglass used in insulation, but has some advantages of its own.

It is used mostly for thermal insulation. While it is good at this, it also is effective to dampen sound. Its other attributes make it more attractive than other types of insulation for a number of applications. It is not attractive to vermin, and does not support growth of mold. It can dry fairly efficiently, if it gets wet. One really important characteristic is that it is a good barrier to fire. It can provide an insulation value of R4 per inch, which is similar to dense fiberglass and blown cellulose.

It can be used in a number of ways. It can be blown into hollows in walls and similar places. It is used to provide insulation in modular products, such as structural insulated panels. It can be applied in batts. These forms of insulation are now becoming more available, as large companies are making them. Owens Corning produces the Thermafiber brand. Roxul, a subsidiary of the Danish company, Rockwool International, may be the largest North American producer, selling its product

under its own name. There are a number of smaller producers as well.

Rock wool may not be the first thing to come to mind, when insulation is considered, but it deserves some thought. Eric Solsaa, of Solsaa Energy Solutions in Rutland, Vermont, specializes in insulation. Several years back he faced a somewhat unusual problem of having to fill architectural spaces as large as 14 inches. "I was not comfortable with the idea of filling this space with blow-in cellulose," he said, "so I started doing a web search for alternatives."

Eventually, Eric found a company in Texas that could provide him with what he wanted. "The rock wool was mixed with a binder for this," he said. "It came in a five-gallon tub, to be mixed with water. The rock wool was then blown into the spaces."

Eric says not everyone he knows in the insulation industry likes blowing rock wool with a binder, because it is hard on some types of machines. Nevertheless, he uses it and is happy with the results.

He is particularly happy with two points. One is that damp rock wool seems to lose its moisture faster than cellulose would. This is very important in frame buildings. Another thing is that rock wool is a good fire barrier, and so contributes to the safety of a building where it is used.

Though a number of insulation specialists who blow in rock wool, not all do. Solsaa Energy Solutions in Rutland, Vermont can be found at <http://www.rutlandinsulation.com>. Another is Green Cocoon, in Salisbury, MA, whose web site is [www.thegreencocoon.com](http://www.thegreencocoon.com).

Source: <http://energy.gov>

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# BUILDING BEYOND EFFICIENCY - BREAKING THE NET-ZERO BARRIER

By George Harvey

How would you feel if you heated, cooled, and lighted your home with electricity, but when the utility statement came, it included a check made out to you? How would you feel if the check covered the cost of all other energy used

in the house, such as the propane you used to heat water and cook? How would you feel if there were enough left over to go out to dinner and celebrate?

If you can picture that in your mind, you can picture going beyond efficiency, past net-zero, all the way to net-positive energy production (also called "net-negative use"). If you have net-positive production, you are making more power than you use. Net positive production is not just a theoretical goal. It is a goal that is being met.

Wes Parlee owns a net-positive producing house in Devens, Massachusetts. He explains the feeling of being net-positive with these words: "I know it sounds funny, but it almost feels like stealing. It's amazing!" His average cost for utilities is a monthly credit of \$58.

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Devens Green, MA Custom Zero Energy Home - Parlee front



Devens Green, MA Custom Zero Energy Home - Parlee interior



Transformations Award Winning Custom Home at 14 Cavite St., Devens Green, MA

It may feel like he is stealing, but it is hardly undeserved. When he started planning his new house, he turned to Carter Scott of Transformations, Inc., which is located in Townsend, Massachusetts. Transformations teamed up in 2009 with Building Science Corporation, a research partner with the Building America Program of the U.S. Department of Energy (DOE), to learn and apply the latest in building science techniques.

The result of Carter's experiences is a sure knowledge of an intricate set of scientific, architectural, engineering, and construction principals that allow him to sum up in a single structure all the values connoted by a single, simple English word: cozy.

A more technical description includes the facts that above ground, the building is double-walled and has insulation of R-45.6. The ceiling has insulation of R-67. Additional attention was put into making sure moisture management was correct. The slab is insulated to R-10, and the foundation walls to R-20. Windows are R-5.0 and are carefully sealed and flashed; their solar heat-gain coefficient is 0.19. As a last touch, attention to air leakage was careful enough that blower door testing

produced results significantly better than standard.

Heat is supplied by super-efficient air-source heat pumps that are at 92% of rated efficiency when the outside temperature is 5°F, and 58% when the temperature drops to -13°F. During the summer heat, the same equipment can cool the house, but with so much insulation cooling is generally not necessary.

There are no incandescent lights used, and so far all lights are CFLs. All appliances are ENERGY STAR rated.

The house would have a Home Energy Rating System (HERS) rating of 34, if it did not have a PV system. With solar power part of the plan from the start, generous roof space was allocated to a system of 78 PV panels with a combined rated output of 18.33 kW, and an expected annual output of 10,200 kWh. This brings the house to a HERS rating of -21, a rating that means that the house generates a good deal more power than it uses.

The Parlee House is a 2013 DOE Challenge Home Winner as a Custom Home. Kudos to Wes Parlee. Kudos to Carter Scott. Kudos to Transformations, Inc.

Transformations' website is transformations-inc.com.

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# BUILDINGENERGY 14: A CULTURE OF CURIOSITY

By Travis A. Niles

The Northeast Sustainable Energy Association (NESEA) and its members are organizing the BuildingEnergy 14 Conference and Trade show at the Seaport World Trade Center in Boston, March 4-6, 2014. This event is the region's oldest gathering of high performance building and renewable energy practitioners. Known as "BE" to regulars, it's so much more than an educational and networking event. It's a nexus of creativity and knowledge for those passionate about building a better world. In the words of NESEA Member and Conference Track Chair Fred Unger, BE stands out because of the "technical proficiency and culture of curiosity" that prevails throughout the conference, indeed, it is for this reason that he hasn't missed a conference since the late 1980's. South Mountain Company's John Abrams concurs, saying "...it's become home. It's gravity...it's an important part of my life."

## Unwavering Commitment To Doing The Future Right

NESEA got its start in the late 1970s in Brattleboro, Vermont as the New England Solar Energy Association, a grassroots organization comprised of solar energy pioneers that advocated for renewable energy adoption. Its conference has known different names, different themes and venues through the years, but at all times, it was known as the place to be to get the pulse of the New England energy market. This was, in part, due to the multidisciplinary nature of the people it attracted. Says Unger of his early days with NESEA and BE "nowhere else have I found such a multidisciplinary group that demands honesty, competence and credibility from everyone." The organization and its conference grew and evolved through what could be called a



TOP: Speakers and attendees swapping stories on the show floor of BuildingEnergy 13 before joining a special alumni session of the BuildingEnergy Masters Series. LEFT: Alex Cheimets (center) of the Fraunhofer Center for Sustainable Energy Systems leads a group of BuildingEnergy attendees on a tour of Fraunhofer's Building Technology Showcase. RIGHT: Ryan Cook, Nick Karas, Kate Goldstein and Jean Carroon participate in the BuildingEnergy 13 closing forum "What will the hot topics be at BuildingEnergy 2025?" Photos: Matthew Cavanaugh Photography

"cycle of empowerment." As the renewable energy and green building fields grew, practitioners ran into challenges trying to do the best possible work. They asked tough questions and found answers - and kindred spirits - with NESEA connections, and through the conference they were able to educate and energize others who shared in their struggle and their commitment to

building a sustainable future. This process of creating a conference by practitioners, for practitioners, means rigorous vetting of hundreds of ideas, and a fair share of "no's". But this distaste for greenwashing and preference for open, honest learning clearly

works, as NESEA is gearing up to once again welcome 130 exhibitors and 3000 attendees to the Seaport World Trade Center.

## The Pursuit of Mastery

This year's BuildingEnergy theme is Advancing Your Practice, and there will be plenty of opportunities to do just that. The conference offers over 80 fully accredited educational sessions and workshops on green homes, energy policy, sustainable building materials and green business. It will also feature a Keynote Address by architect Amanda Sturgeon, Program Director of the Living Building Challenge. Ms Sturgeon will be speaking on how to advance sustainable, accountable design into the next century. Other featured events include the presentation of the \$10,000 Zero Net Energy Building Award and Student Design Competition Award Ceremony.

There'll also be plenty of networking opportunities for current practitioners and job-seekers alike. As Fred Unger recounts, "I've made a number of career moves over the years, and I can say with absolute certainty that when I've made these changes, it's the things I've learned and the people I've met through NESEA and the BuildingEnergy conference that made those transitions successful."

The energy and building markets are evolving rapidly. Now is the time to be paying attention to the issues, to build buildings and systems with purpose and integrity. Join NESEA in Boston for BuildingEnergy 2014.

More at [www.nesea.org/buildingenergy](http://www.nesea.org/buildingenergy).

Travis A. Niles is Manager of Communications and IT. 🐦

## TIME TO BREAK OUT OF NEW HAMPSHIRE'S ENERGY EFFICIENCY DOLDRUMS

By Laura Richardson

When the thermometer reads 10° below zero and four inches of poor insulation separates you from the bitter cold, you might consider what it takes to raise the interior temperature 70° to keep your home or business reasonably warm -- and what impact that has on everyone else.

At a recent Business and Industry Association meeting, Democratic Rep. David Borden of New Castle noted that each year in New Hampshire we spend about \$6 billion on energy, and we probably waste a third of that. I think his estimate is conservative; our buildings hemorrhage energy.

High demand combines with limited transmission capacity to make high costs, and these result in reduced productivity and layoffs. Yet some people complain that they could not stomach expanded public funding for energy efficiency, when they are already faced with exorbitant energy costs.

There is a direct connection between cost volatility for industrial energy users and demand spikes from other sectors. Improving the energy performance of residential, municipal and commercial buildings would mean less energy needs to be transmitted. In many cases

a 50% reduction of energy use is quite feasible -- which in turn would reduce energy demand system-wide, and thus reduce energy prices for everyone. There is no rate of return on wasted energy.

New Hampshire has studied this problem for many years, with one study leading to another, but very little action. An effort to develop an energy strategy for New Hampshire, currently under way, should provide additional guidance on next steps. Certainly, ramping up energy efficiency efforts in buildings will be a key recommendation. Can't we start working on it sooner rather than later?

Adding pipelines and transmission lines is not a solution; they simply provide a mechanism to waste more. Energy efficiency should be considered an energy resource. If we can better manage energy use, we don't need to expand energy capacity. In many cases, it is less expensive to "buy" energy efficiency than to buy the energy itself. "Least-cost procurement" is a Yankee attribute we have so far failed to incorporate into our utility regulations and energy practices.

Our reason include saving money,

Cont. on page 34





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# MORETOWN'S SECOND PASSIVE HOUSE IS UNDERWAY

## HOUSE WILL BE HEATED WITH THE EQUIVALENT OF FIFTEEN 100W LIGHT BULBS

By Indigo Ruth-Davis

Head north leaving Montpelier, Vermont, hang a right, and before you know it, you'll be lost on the dirt roads that crisscross the foothills of the Green Mountains. On the side of one of these hills, a crew of workers is installing triple pane, high-solar-heat-gain, R-9 windows on a super-insulated timber frame house. These windows will provide more heat to this house than its entire heating system. Active heating will be necessary only on the coldest winter days. On those cold days the house will be heated with the equivalent of fifteen 100w light bulbs.

This is the Timber Frame Passive House Cottage. The setting is rural, the style, well, DIY-rustic, and its design is certified passive. While the tools to build a house that performs this well are basically the same as a conventional building, the design process requires a new set of tools.

### The secret to a Certified Passive House Consultant is The Tool Box, which consists of:

- The Passive House Planning Package, an energy modeling program
- WUFI-ORNL, a Hygrothermal analysis program
- THERM, a thermal bridge analysis program
- The Solar pathfinder, a shading calculation tool

The most important of these tools is the Passive House Planning Package (PHPP). It was developed by the Passive House Institute, (in Germany) in the 1990s -- to simplify the energy balance calculations that are necessary to meet the Passive House standard. Areas for each building component, R-values, window performance values, shading conditions, and information about the mechanical systems are entered into the program. The PHPP combines this with climate data and calculates the energy use of the building's design.

At the cottage, clients Greg and Barb Whitchurch knew they wanted to build a small, well insulated house for their parents. When Greg showed me Barb's sketch of what they had in mind, I said



The Solar Pathfinder is used for shading analysis.

"that's a Passive House." This project didn't have a professional architect, so getting there required intense collaboration among the homeowner, the builder Chris Miksic of Montpelier Construction and me, the certified Passive House consultant.

The first step is to complete a rough PHPP. Every building's geometry, size, orientation and climate have different implications for its energy balance. This is the heart of performance-based design. In our case the Passive House design criteria of 4.75 kBtu/sq. ft./yr. called for 16 inches of dense-pack cellulose for R-56 walls and 22 inches of dense-pack cellulose for an R-77 roof. This is based on the maximum allowable air tightness in a Passive House of .6 ACH@50 pascals. The initial PHPP takes a few days to complete.

The next step is to analyze the site's shading conditions. Harvesting heat from the sun is serious business in a Passive House, so accuracy in the shading analysis is all-important. For complex shading conditions such as mountainous locations this is best done with the Solar Pathfinder. The Solar Pathfinder consists of a dome that projects shading objects at the building site onto a sun-path chart. Shading percentages are tallied and then entered into the PHPP for radiation reduction factors.

Before the assemblies are finalized they should be analyzed for moisture and mold risk. Hygrothermal analysis is more important in high-performance building because of higher temperature differentials within the wall assemblies. I use WUFI-ORNL for this analysis because it's free and is suitable for most non-commercial construction.

In our project the roof design required special attention. The plan called for 22 inches of cellulose under a flat unvented membrane roof. On a flat roof, condensation risk is usually mitigated by adding vapor closed foam insulation to the outside of the assembly to a thickness

Cont. on page 30

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LOW ENERGY VENTILATION

Cont. from page 30

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Ventilation for cooling is the least expensive and most energy-efficient way to cool buildings. Ventilation works best when combined with techniques to avoid heat buildup in your home. In some climates, natural ventilation is sufficient to keep the house comfortable, although it usually needs to be supplemented with spot ventilation, ceiling fans, window fans, and—in larger homes—whole-house fans. Ventilation is not an effective cooling strategy in hot, humid climates where temperature swings between day and night are small. In these climates, however, natural ventilation of your attic (often required by building codes) will help to reduce your use of air conditioning, and attic fans may also help keep cooling costs down.

Websites on ventilation can be found at [www.greenenergytimes.net/ventilation-links/](http://www.greenenergytimes.net/ventilation-links/)

EFFORTLESSLY GROWING PLUMS IN VERMONT

By David Fried

Everyone is planting gardens. But who is planting fruit trees and nut trees? While you have to plant a garden every spring, you only plant a fruit tree or a nut tree once, and it bears fruit for a long, long time. Let your tree's roots mine the moisture and nutrients it needs, while you have more time to play with your kids, to write a book or hike a hill. Real permaculture is seeing what you can do in your yard and on your hill to feed yourself and your family and using that wisdom throughout your life. Living with fruit and nut trees, they will teach you as you go. Don't be hesitant. Start planting. Be fruitful. And we will coach you along the way...

If you are walking next to me in late August and September, your shirt will be ruined. These hills are a place where plum trees grow and when they are ripe. The plums are so juicy that one bite sends their mango-like nectar spurting over whatever you are wearing, so watch out.



Would you like to taste a golden plum? A red one? A purple one? We have them all. Let me tell you how they got here to our northern Vermont farm. In 1979 I was hiking the Long Trail north and lived on fruits and berries. When I came down from the mountains, I was offered a place to live and I started

planting fruit trees. The local extension agent told me that I could only grow apples here, and only a few kinds. But I was a rebel! I started fruit exploring. If I saw an unusual fruit at a farmer's market, I would ask the grower what it was and where did he or she get it? In this way, I got some cuttings of plum trees and pear trees from them that had been growing in the same area as I was living, and had proven they could make it here.

I had to learn to propagate these cuttings by grafting. Then I had to be patient, as it can take five to seven years for a new baby tree (made of only two buds) to give its first fruit. Now, 35 years later, we have had many plantings of plum trees all over our hills and they continue to blossom and fruit and tantalize my taste buds.

The plums you find in stores are large, hard and picked before they are ripe (so they keep well as they come across the country and sit in boxes). The ones you and I can grow here were developed by skilled pioneers who also lived in the north country. Professor S.E. Hansen in South Dakota, Professor Brian Smith in Wisconsin, and Professor Elwyn Meader in New Hampshire all introduced new plum varieties. They were natural crosses of large, sweet but not-hardy-for-here, Japanese varieties, with super-hardy local plum species. The results are some of the most exotic yet easy-to-grow fruits we have.

They have names like "black ice," "kahinta," "la crescent," "cocheco," "toka." You are keeping the stories alive by planting, growing, eating and sharing them.

One of the secrets we have rediscovered is that plum trees like to grow rather closely in "plum thickets." Whether or not you plant them this way, they will seek to establish their own closely growing group by sending up "plum suckers" in every which way. You can easily "steer" them by mowing or lopping.

My hypothesis is that within a tight group, their flower buds have enough



some of their fruit has enough camouflage to elude the plum curculio beetle. It works, and we get thousands of plums without any sprays. We do sing to them. And give them 'high-fives' from time to time.

If you don't have enough time or enough friends to eat them all fresh, you can freeze them whole to make jam or pies or sauce later. We like to dry them in a dehydrator, simply split with our fingers and laid out on the trays. They keep for a long time like this and taste more like dried apricots than prunes.

We have been growing plums successfully in northern Vermont and you can too. You can pick almost all of them from where you are standing on the ground. They often look like a Zen garden and when they are in blossom, all is right with the world. You may want to have a picnic table or a loveseat among your plum grove, for you will be spending some good days out here. They give you an outdoor place where you can feel right at home.

Anyone moving toward sustainability though permaculture can benefit a lot by planting fruit trees. They take time to get to harvest, so planting them should be done as early as possible. If you want to plant them this year, it is best to start planning now.

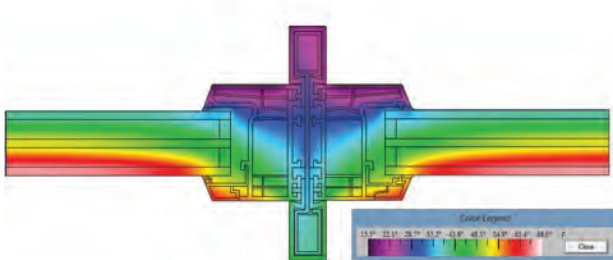
David Fried will be sharing his thoughts in this column to share tips and proven techniques that will help us all to get on that path to Permaculture. He is the founder and grower of Elmore Roots Fruit Tree and Berry Nursery in Elmore, Vermont. Visit [elmoreroots.com](http://elmoreroots.com) or call (802)888-3305 to reach him

MORETOWN'S SECOND PASSIVE HOUSE

Cont. from page 29

determined in the building code for each climate zone, or by back venting below the roof deck. When I modeled the proposed unvented roof, WUFI-ORNL indeed predicted that the assembly would not be able to dry out and therefore the moisture content in the building materials would slowly rise over the seven year period that I analyzed. I compared this assembly to a back vented assembly. The results were dramatic. With only 1 ACH in the back venting plane, the roof assembly showed a significant dry-out over the seven year period. Based on these results I advised my client to add a ventilation plane to the roof assembly.

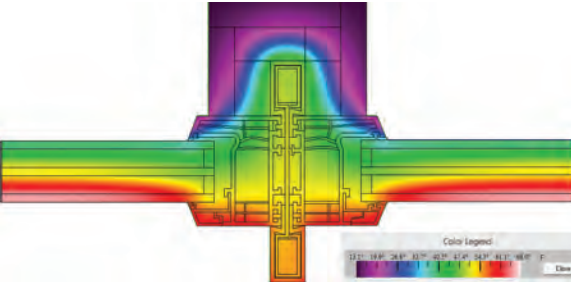
The final step in the design is to look for potential thermal bridges and either eliminate them, or account for them in the PHPP. Thermal bridges that can't be eliminated need to be modeled in a two-dimensional heat transfer program such



THERM simulation of our window mullion thermal bridge in plan view.

as THERM, which is free from the Lawrence Berkley National Lab.

Our biggest thermal bridge concern was our window connection mullions. To determine if they were a thermal bridge I first drew them in THERM with the window frame geometry. Then THERM runs a heat transfer simulation with and then without the mullion. The conductance of just the mullion is determined by subtracting



THERM simulation of our insulated exterior trim solution.

the results with the mullion from those without the mullion. This number is entered into the PHPP. The mullion thermal bridge ended up throwing off our energy balance and was a condensation risk. We used THERM again to determine that an exterior trim piece that incorporates an EPS foam gump significantly improves this thermal bridge.

I enjoy being able to bring the precision of the PHPP, WUFI and THERM to the design process. Informed decisions instead of best guesses become the basis for a Net Zero-ready design fit for the 21st Century. Indigo Ruth-Davis is a Passive House Institute US Certified Passive House Consultant and builder. He is a partner at Montpelier Construction, one of central Vermont's leading building performance companies.



# EMERGING FRONTIERS IN BIOENERGY

## FROM PONDS TO FUEL TANKS: THE ROLE OF ALGAE IN OUR ENERGY FUTURE



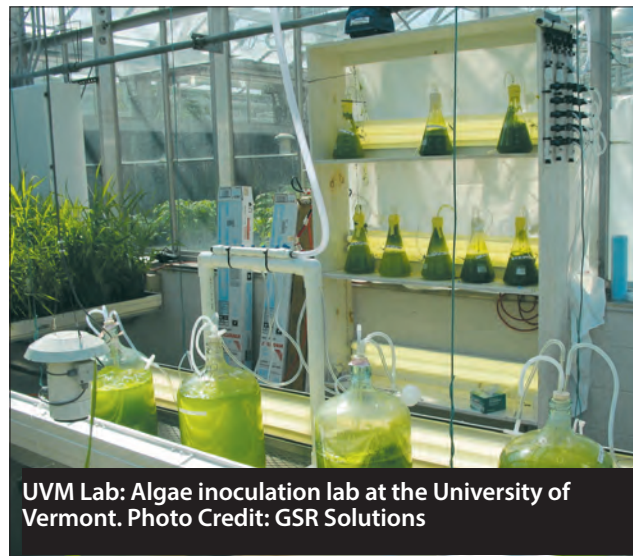
By Sarah Galbraith, program manager of the Vermont Bioenergy Initiative

A great deal of interest about the potential of oil-rich algae as a bioenergy feedstock has surfaced in recent years. It's already big business in certain parts of the world. In the United States, students, researchers, and innovators are looking for

making biodiesel, which could displace substantial volumes of petro-diesel for heating and transportation. Microalgae reproduce rapidly, and they grow on non-agricultural land, so they do not compete with food, feed, or fiber production.

With funding from the US Department of Energy secured by US Senator Patrick Leahy, the Vermont Bioenergy Initiative has supported a number of algae to biofuel research projects. This early-stage research and development is determining the most viable and cost-effective methods for accessing algae's commercial potential to produce clean renewable energy while treating wastewater and supplying nutrient-rich feeds and food.

Dr. Anju Dahiya, president of General Systems Research (GSR) Solutions, a recipient of grant funds from the Vermont Bioenergy Initiative, has been looking for high lipid algae strains, and scaling those



ways for algae production and processing to accomplish wastewater and nutrient management while also producing algal oil for fuel and algae for animal or fish feed.

Algae produces more than half of the oxygen on the planet, while consuming vast amounts of heat-trapping carbon dioxide and taking up nutrients like nitrogen and phosphorous to make biomass and energy. The lipids, or oil, that algae produce can be extracted and processed into renewable fuels such as biodiesel. Algae are an excellent source of oil for

up to a level that could be available for commercial use, especially for biofuels. "At GSR Solutions, we are looking at producing algae not just for biofuels, but combining it with waste water treatment and to produce other valued byproducts as well. This is very significant, because this would make algae production cost-effective. This would also help in nutrient recovery," says Dahiya.

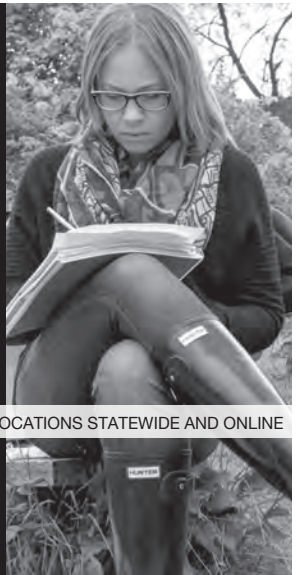
GSR Solutions will be assessing the feasibility of growing oleaginous algae strains in the company's private lab in Burlington for up-scaling with waste streams from

dairy farms and breweries. These strains will create a biodiesel product that is interchangeable with home heating oil, diesel, and jet fuel. In addition, the process can produce an organic fertilizer that can substitute for imported synthetic versions.

For more on the potential for algae to produce biofuels and other products here in Vermont, including videos, reports, an image gallery, and helpful links, visit [www.vermontbioenergy.com/algae](http://www.vermontbioenergy.com/algae).

The Vermont Bioenergy Initiative is a program of the Vermont Sustainable Jobs Fund and partners with other organizations expanding the use of renewable energy in Vermont like Renewable Energy Vermont and the Energy Action Network. The Vermont Bioenergy Initiative also coordinates crossover with the Vermont Farm to Plate Network by providing resources and technical assistance to farmers, facilities, and communities to support energy crops to be grown alongside food production. [www.VermontBioenergy.com](http://www.VermontBioenergy.com)

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Bachelor's degree plus 10 years experience as a Wastewater/Water System Operator or similar industry experience with a minimum of Grade V certification as a Vermont WWW Operator or equal accreditation. A fingerprint supported criminal background check is required.

For more information on this position and others currently under recruitment, including how to apply, please visit the Vermont Tech website at [www.vtc.edu](http://www.vtc.edu).





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# HILLTOP MONTESSORI SCHOOL IS 100% SOLAR POWERED, INSTALLED AT NO COST!

By N.R. Mallery

Hilltop Montessori School in Brattleboro, Vermont, is an independent school for children age 18 months to 8th grade. "The installation of solar will allow the school to further its mission," the head of the school, Tamara Mount, stated, "teaching students about conservation and renewable energy -- taking care of our planet, which is an important part of Montessori educational philosophy."

On Dec. 31, 2013, Hilltop Montessori School activated 192 roof-mounted PVs, which will generate approximately 60,000 kilowatt-hours of electricity per year. The 11.4kW system has 192 Hanwha 250W PV Modules and four Fronius Isolated String Inverters. It will supply the school with 100% of the power it needs.

The solar system is monitored with a Fronius Web-based monitoring system. The school is awaiting a grant from



Investor John Langhus of Wisdom and Power LLC and Hilltop Montessori head of school, Tamara Mount shaking hands.



South facing roof of Hilltop Montessori School. The 11.4kW system consists of 192 Hanwha 250W PV Modules

Solar4RSchools for a computer kiosk for the lobby, as well as other educational materials. "Integrated Solar shepherded the project through to fruition. They conducted feasibility studies, introduced the school to investors, and installed the system. It was a turn-key product," said Seth Harter, one of the parent volunteers who helped the school explore the possibility of solar power. "It's been wonderful working with them and a fantastic opportunity for the school."

The solar array was installed at no cost to Hilltop. Wisdom and Power LLC invested the capital to install the array and in return, Hilltop will pay the firm 90% of the current kWh rate for service from Green Mountain Power. After seven years, the school may choose to purchase the panels

at fair market value, or continue to pay the investor.

Hilltop moved to its current location five years ago, after renting space at the Austine School for the Deaf. On the newly purchased property, they built a new building designed to be as energy efficient as possible, and with the forethought of installing solar panels. They are currently

build an 'arts barn,' and a multi-purpose building, both built with energy efficiency in mind. Both buildings have SIPs panels manufactured locally at Foard Panels in West Chesterfield, NH.

"Our school culture incorporates other sustainable measures, like composting, recycling and gardening," said Development Director Amelia Farnum. "The students take responsibility for all of these - students as young as three learn which bin is for recycling, which is for composting and which is for trash. Older children have 'jobs' of collecting compost and recycling." The school is situated on 43 acres, including a large garden.

They have also done some routine weatherization. This includes an energy

assessment of the school done by the Vermont Superintendents Association and an energy audit done by Farnum Insulators.

Fulfilling their mission step by step is becoming a reality for Hilltop Montessori School. The children who are fortunate enough to attend the school are learning to walk a sustainable path that will lead to a clean responsible future! ♡



Middle Schoolers with their composting/recycling "center" that they built.

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One of several options for early childhood teachers and administrators

Keene, NH -- Earn a certificate in nature-based early childhood education! Starting this summer, Antioch University New England's (AUNE) Department of Education will offer a certificate in nature preschool/forest kindergarten professional development.

The certificate is a professional development option for early childhood teachers and administrators. It is an excellent option for early childhood professionals

who want to take more of their conventional programs outdoors, and entrepreneurs who want to start a nature preschool or forest kindergarten program.

Participants take a set of four to six courses over thirteen months, from summer to summer. All courses are either on weekends or offered in week-long intensives. The courses can earn continuing education credits or graduate school credits.

The Nature Preschool and Forest Kindergarten movement has been thriving in Europe for the last three decades. It has recently taken root in the United States, and the AUNE program, under the direction of senior faculty member David Sobel, aims to support its healthy growth in New England and throughout the country. The certificate program provides exceptional professional devel-

opment, training, and leadership in the exciting new field of nature-based early childhood education. AUNE received a \$117,000 grant from the George B. Storer Foundation to develop the certificate program.

Other options:

Matriculated students in AUNE's Teacher Certification/Integrated Learning Master of Education (MEd) program may specialize in nature-based early childhood education within the Elementary Education Certification/Integrated Learning Program.

The twelve to fifteen credits earned for the certificate may be transferred, within five years, into the Elementary Teacher Certification/Integrated Learning program MEd.

The third nature preschool/forest kindergarten annual conference, In Bloom in Keene, will take place May 16 at the AUNE campus in Keene, New Hampshire. An urban version of this conference, In Bloom in Boston, will take place at Boston Nature Center on May 13.

Find more information, including classes that will be offered in summer 2014.

Learn more about Antioch University New England at: [www.antiochne.edu](http://www.antiochne.edu). ♡



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## EXPLAINING GLOBAL WARMING TO OUR KIDS

By EarthTalk®

Kids today may be more eco-savvy than we were at their age, but complex topics like global warming may still mystify them. Luckily there are many resources available to help parents teach their kids how to understand the issues and become better



There are many resources available to help parents and educators teach kids how to understand the issues and become better stewards for the planet. Photo Credit: Global Imagination

Cont. on page 35



# VERMONT TECHNICAL COLLEGE'S ANAEROBIC DIGESTER

By George Harvey

Can you imagine anything more exciting than an anaerobic digester, filled with waste food scraps from a school cafeteria, agricultural spoilage, chopped hay, and lots and lots of manure, pumping out methane (aka swamp gas)? If you can answer "yes" to this question, I suggest a chat with Mary O'Leary, an Assistant Professor at Vermont Technical College in Randolph. She may not change your answer, but she will, at the very least, make you understand the question in a new light.

Mary is the project manager of VTC's new Anaerobic Digester Project. The project is under way, and is expected to produce heat and power from the beginning of March. It is expected to produce 375 kW of power, and the waste heat from the generator will be captured to heat four buildings, which will be connected in time.

Anaerobic digestion is a natural process, which can be understood from the workings of a cow's stomach. Bacteria break down cellulose and other nutrients, using some of the energy in them as food. If there is no oxygen available, the bacteria ferment the food in a way that releases methane gas.

Methane from the process is the most important constituent of natural gas, and can be used just about anywhere natural gas is used. In the case of VTC, the gas is used to run a generator, supplying power to the grid as a net-metered project. When waste heat is captured, the whole process is highly efficient.

Best of all, the VTC anaerobic digester provides a set of very important benefits

to the environment. One is that it is a renewable source of both electricity and heat.

Another environmental benefit is that the system prevents methane from manure from getting into the atmosphere. Methane is estimated as having twenty to forty times the power of carbon dioxide as a greenhouse gas, burning it to carbon dioxide is a benefit, for global warming.

Additionally, by intercepting waste from various sources, the system reduces the load on conventional waste-handling facilities. The feedstock is 51% manure, spoilage, and hay. The rest will be food waste and by-products, including whey and waste from dining facilities. Various organizations are partnering with VTC for this, including local farms. Grow Compost will be supplying waste from food sources, and Highfields Center for Composting is working with VTC on training and research (links at the end of the article). Other waste may come from dairies, breweries, restaurants, and other sources.

The digester needs 450,000 gallons of feedstock just to get started. Once it is going, 15,000 gallons has to be added each day. Clearly, some of this would have been used as fertilizer in the past. There is no reason to feel bad about that, however, because the by-product of the process can also be used as fertilizer, and since non-agricultural waste is used, there is more of it. We might note that human waste will not be used, and permits to process food scraps have requirements for specific monitoring to make sure operations are within parameters for good health.

That the system is handling food waste



VTC's Anaerobic Digester. Photo courtesy of VTC.


is especially important because we are currently phasing out sending such waste to landfills. It will no longer be legal to send food waste to landfills as of 2017.

Funding for VTC's anaerobic digester included a \$1.5 million grant from the Vermont Sustainable Jobs Fund capital funding comes from grants from the U.S. Department of Energy, obtained with the help of U.S. Senator Patrick Leahy, and bond funding from the Vermont State Colleges. And invaluable help and funding have been provided by many other generous organizations and individuals including Vermont's Clean Energy Development Fund, the Vermont Agency of Agriculture, Food and Markets, the Vermont's Agency of Natural Resources, Vermont's Depart-

ment of Public Service, the SPEED program, the Natural Resource Conservation Service, the Kresge Foundation, the Town of Randolph, and the Tri-Town Alliance.

Stone environmental (stone-env.com) did a map showing amounts of waste. Bio-Metatech of Quebec (bio-methatech.com) designed the Lipp AD system and is overseeing construction. J. Hutchins of Richmond, Vermont did the site work. R.G. Gosselin of Derby Line, Vermont (rggosselininc.com) did the concrete work.

Highfields Center for Composting (highfieldscomposting.org), Grow Compost (growcompost.com) accepts home food scraps, and these can be used.

VTC's digester has its own site at digester.vtc.edu. 

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In Bloom in Keene, AUNE's third annual nature preschool/forest kindergarten conference, May 16, in Keene, New Hampshire. Stay tuned for more information.



Photo: Bob Bailie



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**Dsireusa.com:** [www.dsireusa.com](http://www.dsireusa.com) Renewables & Efficiency. Find state, local, utility, & federal incentives for renewable energy & energy efficiency.

**IREC/ Interstate Renewable Energy Council:** RE educational info. [www.irecusa.org](http://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](http://www.nabcep.org)

**NESEA/ Northeast Sustainable Energy Assoc.:** [www.nesea.org](http://www.nesea.org)

**New Hampshire Sustainable Energy Assoc. NHSEA** Focused on N.E. US, for consumers & industry- RE & clean building info, events. [www.nhsea.org](http://www.nhsea.org)

**New York Solar Energy Industries Association/NYSEIA** [www.nyseia.org](http://www.nyseia.org)

**Clean Power Estimator:** [www.consumerenergycenter.org/renewables/estimator](http://www.consumerenergycenter.org/renewables/estimator)

**Find Solar:** [www.findsolar.com](http://www.findsolar.com)

**Energy Star Federal Tax Credits:** [www.energystar.gov/tax\\_credits](http://www.energystar.gov/tax_credits).

**Tax Incentives Assistance Project (TIAP):** [www.energytaxincentives.org](http://www.energytaxincentives.org)

**American Solar Energy Society (ASES):** [www.ases.org](http://www.ases.org)

**Energy Efficiency & Renewable Energy Clearinghouse (EREC):** [eetd.lbl.gov/newsletter/CBS\\_NL/nl6/Sources.html](http://eetd.lbl.gov/newsletter/CBS_NL/nl6/Sources.html)

**Federal Energy Regulatory Commission (FERC):** [www.ferc.gov](http://www.ferc.gov)

**National Association of Energy Service Co. (NAESCO):** [www.naesco.org](http://www.naesco.org)

**National Renewable Energy Laboratory (NREL):** [www.nrel.gov](http://www.nrel.gov)

[www.susdesign.com/tools.php](http://www.susdesign.com/tools.php) Online info for solar benefit with house design. i.e. window overhangs, sun angle & path...

**NFRC** independent rating & labeling system for the windows, doors, skylights [www.nfrc.org/](http://www.nfrc.org/)

**NH Office of Energy and Planning:** [www.nh.gov/oep/programs/energy/RenewableEnergyIncentives.htm](http://www.nh.gov/oep/programs/energy/RenewableEnergyIncentives.htm)

**Energy Efficiency & R/E Clearinghouse (EREC):** [eetd.lbl.gov/newsletter/CBS\\_NL/nl6/Sources.html](http://eetd.lbl.gov/newsletter/CBS_NL/nl6/Sources.html)

**Federal Energy Regulatory Commission(FERC):** [www.ferc.gov](http://www.ferc.gov)

**Solar Living Source Book:** [www.realgoods.com](http://www.realgoods.com)

**Home Power Magazine:** [www.homepower.com](http://www.homepower.com)

**Solar Components:** [www.solar-components.com](http://www.solar-components.com)

**Backwoods Solar:** Specialty: solar, off-grid - [www.backwoodssolar.com](http://www.backwoodssolar.com)

**Solar Systems:** [NEsolar.com](http://NEsolar.com)

**National Solar Institute:** [www.nationalsolarinstitute.com](http://www.nationalsolarinstitute.com)

**NeighborWorks® Alliance of Vermont:** Low-cost energy loans - [www.vthomeownership.org](http://www.vthomeownership.org)

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

**Home Energy Saver:** Interactive site to help you identify & calculate energy savings opportunities in your home. A lot of great information! - [hes.lbl.gov](http://hes.lbl.gov)

**American Council for an Energy-Efficient Economy:** Consumer guide to home energy savings - [aceee.org/consumer](http://aceee.org/consumer)

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

**SmartPower:** [www.smartpower.org](http://www.smartpower.org)

**Greywater Info:** [www.oasisdesign.net/greywater](http://www.oasisdesign.net/greywater)

**Weatherization, Energy Star & Refrigerator Guide:** [www.waptac.org](http://www.waptac.org)

**Buildings Energy Data Book:** [buildingsdatabook.eren.doe.gov](http://buildingsdatabook.eren.doe.gov)

**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](http://www.eere.energy.gov)

**VPIRG:** understand the clean energy resources available to VT - [www.vpirg.org/cleanenergyguide](http://www.vpirg.org/cleanenergyguide)

**Track the Stimulus Money:** [www.recovery.gov/Pages/home.aspx](http://www.recovery.gov/Pages/home.aspx)

**Dept. Public Svc. (CEDF):** [publicservice.VT.gov/energy/ee\\_cleanenergyfund.html](http://publicservice.VT.gov/energy/ee_cleanenergyfund.html)

**Renewable Energy World:** [www.renewableenergyworld.com](http://www.renewableenergyworld.com)

**Renewable Energy VT:** [www.REVermont.org](http://www.REVermont.org)

**The Energy Grid:** [www.pvwatts.org](http://www.pvwatts.org)

**350-Vermont:** General group that coordinates a variety of statewide actions. To join this group go to: [groups.google.com/group/350-Vermont](http://groups.google.com/group/350-Vermont)

**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](http://groups.google.com/group/vt-tar-sands-action)

**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](http://groups.google.com/group/fossil-fuel-freedom)

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

THE UN REPORT ON CLIMATE CHANGE

By George Harvey

The UN panel on climate change has issued its Fifth Assessment Report, Climate Change 2013. It makes one point very clear:

Climate change is real, and it is caused by human beings.

The scientific community has come to the point that it sees no viable alternative to this view. There is no other scientific explanation for what is going on.

Deniers of all stripes will doubtless continue to deny. Whether it is out of fear of some bogeyman, such as an attempt at world domination, or fear of losing a lifestyle that includes fast cars and an absolute right run the furnace with the thermostat at 72° while running the air conditioning at 68°, they will deny. And how could we expect otherwise - after all there are still some who insist that the world is flat.

The report also makes another thing very clear:

Reducing the effects of climate change will require substantial and sustained reductions of greenhouse gas emissions.

In a nutshell, that means being as efficient as possible, switching to renewable energy sources, and turning to a lifestyle calculated to be sustainable.

We might make the observation here that if a lifestyle is sustainable, then it includes an ability to survive. It should be obvious, but deniers tend to believe a non-sustainable lifestyle is okay, even though it clearly must end at some point. And why would anyone actually choose a social paradigm that is terminal?

Perhaps it needs to be pointed out that if we adopt a sustainable lifestyle, then we gain a possibility of achieving, at some point, a goal that is otherwise impossible:

By living sustainably, we can live healthy, happy lives.

For those who object to this conclusion, it might be pointed out that this is not a guarantee; it is merely a statement of a possibility. However, the converse is also true:

By refusing to live sustainably, we cannot continue to live healthy, happy lives, because eventually we lose the ability to live at all.

TIME TO BREAK OUT OF NEW HAMPSHIRE'S ENERGY EFFICIENCY DOLDRUMS

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reducing susceptibility to price volatility, Yankee frugality, national security, reductions in greenhouse gas emissions, environmental benefits, improved comfort, efficiency-related jobs, economic development, and improved values of physical assets. Whichever your favorite reason may be - we need to stop wasting energy. Now.

How should do we do it? We should get past sticker shock and understand that what we do not spend on energy efficiency we will spend on energy. We are spending the same dollars. Only the energy efficiency dollars have a compounding rate of return.

Laura Richardson is executive director of The Jordan Institute, a Concord-based nonprofit that helps commercial building owners significantly reduce their energy use. ♡

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*“A sustainable human population is one where the people living in a given geographically defined area do not live beyond the limits of the renewable resources of that area for either input (energy and matter) or output (food, material goods, and absorption of pollution)... thereby living in a manner that present and future generations of people, and all other life native to that area, will be able to enjoy a healthy habitat over the long term.”*

**What is an optimum sustainable population for Vermont?**

Read this valuable new report at [www.vspop.org](http://www.vspop.org)





By Larry Pleasant

# Ingredient of the Month

## INTENT

Nothing I have written has raised as much controversy as my repeated assertion that INTENT, along with natural selection and gradual adaptation, is one of the three primary mechanisms of evolution. This month's Ingredient of the Month explores Intent, the guiding force of creativity and possibly even evolution.

More than one friend thinks I am a lunatic on this point. Evolution (they patiently explain) occurs very, very slowly, and over vast amounts of time. Superior genetics usually wins out in the end and biology evolves towards increasing complexity over time. I do not dispute these observations, they seem self-evident.

What is not self-evident is how new creatures, with their new longer, DNA molecules arose. How could these newly evolved monstrosities even survive long enough to be born? And once born and of child-bearing age (assuming it is by some miracle capable of reproduction) another fairly similar critter with the same number of DNA molecules must appear to mate with it. The odds of this happening even once are astonishing. Now imagine this occurring for each unique critter that has ever popped up on this diverse planet.

Superior genetics and the urge towards complexity do not explain the proliferation and diversity of life, (that's you and me, Buckwheat).

You see, it's very difficult for finite

beings (see above) to understand the infinite. Fortunately for people who want to think about such things, life and in fact all of creation has a few basic rules that it uses over and over again. Each new critter that arose here did not need a complete redesign as each new critter is in essence built upon all the operating systems that came before.

As above so below.

This is very easy to prove. For example, one basic principle of life is that it seeks to cover surfaces and declare territory. Photosynthesizers try to cover fertile ground with solar collectors (leaves). My wife covers every unused surface in the house with books. The same principle is carried through all of creation.

Likewise life seeks to cover all possible niches on all possible levels. You didn't think mega-corporations arose out of nothing, did you? They are following a blue print that is hard wired into every creature on earth. Like cancer, it is obvious what happens when organisms are allowed to seize territory unchecked and de-regulated.

My friend Deb insists that only humans have intent. I didn't have the heart to tell her that one of the warning signs of

insanity is the belief that you are the only one! Deb is an intrinsic part of nature. She did not arise in a vacuum and contains the entire range of DNA that came before her. Deb has intent. Therefore intent MUST be part of the biological process that begat her and is reflected in her as a holograph of the universe.

As far as I can tell there are only three possible choices governing the mechanisms of dramatic genetic evolution.

We are here with the ability to have this discussion because of an infinite series of a random coincidences occurring over vast amounts of time. (Coincidence Given Enough Time Theory)

We are here with the ability to have this discussion because forces external to creation guided things to this point (God, Elementals, Fairies, E.T. etc.)

We are here with the ability to have this discussion because the mechanisms of evolution are hardwired into the process and respond quickly to environmental changes. This hypothesis explains how DNA makes major jumps regularly; including adding additional DNA molecules to the strands. These changes or evolution is the result of an inside-out push in response to the ever-changing environment. (Theory of Intent)

That ancient fishy-critter really wanted to crawl around on dirt (who wouldn't - no competition). It must grow legs (huh?) and breathe air instead of water (equally improbable). How does the DNA know what to do? Clearly, DNA responds directly and efficiently the environment it finds itself in. In every generation it will create the offspring that are most likely to succeed. But it doesn't throw every possible

random mutation out there to find the direction to go.

Most mutations never make it to birth -- ask a nurse. Rather, the new critters and the dramatic, sudden jumps and changes in critter form and function are exactly suited to that niche, at that time.

And THAT is what I mean by intent. Nature, like Deb, evolves because it intends itself to do so. This is infinitely more efficient than trying every possible solution to a problem in hope that one of them will work.

Leaves near the ground are becoming scarce because of draught and overgrazing so long-necked critters quickly appear to fill the niche. There isn't time to test every possible leaf-gathering solution before the draught kills off all the leaf eating critters. Clearly the short necked critters running around at that time INTENDED to have longer necks on their shoulders. The scheme apparently worked and their children got that longer neck. We now have the long-necked critters to prove it!

This is what I mean when I say: "The fact that something exists is proof if the universe's intention that it be so."

That is unless you believe in coincidences -- lots and lots and lots of coincidences.

This is the Soapman telling y'all that however you think we came to be here, remember to keep it real, homies. And keep thinking about evolution - you never know where it may lead...

Larry Pleasant is a writer, philosopher, part-time farmer and soap maker living and working in the Green Mountains of VT. Learn more at [www.vermontsoap.com](http://www.vermontsoap.com)

## EXPLAINING GLOBAL WARMING TO OUR KIDS

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calculator—with questions tailored to kids' lifestyles—helps connect everyday actions (like running the water while brushing teeth) and climate change. And a FAQ page answers some of the most common questions about climate change in easy-to-read short paragraphs.

Another great online resource is NASA's Climate Kids website, which engages kids with games, videos and craft activities and offers digestible info on what's causing climate change and how kids can make a difference. A guided tour of the "Big Questions" (What does climate change mean? What is the greenhouse effect? How do we know the climate is changing? What is happening in the oceans? and others) uses cartoon characters and brightly colored designs to help kids come to grips with the basics.

Perhaps even more engaging for those eight and older is Cool It!, a card game from the Union of Concerned Scientists (UCS). The game, designed in collaboration with science educators, requires players to collect "solution" cards in the categories of energy, transportation and forests, while slowing opponents down by playing "problem" cards along the way. "The game enables teachers and parents to talk about global warming in a fun and hopeful way," reports UCS. "Kids, meanwhile, will learn that all of us make choices that determine whether the world warms a little or a lot, and which of those choices reduce global warming emissions." The game is available for purchase (\$7.95) directly from the UCS website.

Younger kids curious about climate change can consult the Professor Sneeze website, which features online illustrated children's stories that present global

warming in a familiar context. The stories for five- to eight-year-olds follow a cartoon bunny on various warming related adventures. A few of the story titles include "The Earth Has a Fever," "Where Are the Igloos of Iglooville?" and "Tears on the Other Side of the World." The site also features stories geared toward 8- to 10-year-olds and 10- to 12-year-olds.

Of course, teachers can play a key role in making sure kids are well versed in the science of climate change. A recently launched initiative from the National Center for Science Education (NCSE)—long respected for its work in defending and supporting the teaching of evolution in the public schools—aims to help teachers do a better job of teaching climate change in the classroom. The group's Climate Change Education website points teachers to a treasure trove of resources they can use to demystify the science behind global warming, combat "climate change denial" and support "climate

literacy"

Contacts: EPA's "A Student's Guide to Global Climate Change," [www.epa.gov/climatestudents](http://www.epa.gov/climatestudents); NASA Climate Kids, <http://climatekids.nasa.gov>; NCSE's Climate Change Education Initiative, <http://ncse.com/climate>; Professor Sneeze, [www.contespedagogiques.be/pages/ac-cueil\\_angl.html](http://www.contespedagogiques.be/pages/ac-cueil_angl.html).

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## DANVILLE, WEST RUTLAND STUDENTS ELECTRIFY TALKING COW'S NAME

An animatronic cow that explains how cow poop can help generate electricity has an electrifying new name – Electra – thanks to two students on opposite sides of the state.

Jared McGee, a student at West Rutland Elementary School, and Dillon Brigham, a student at Danville School, both submitted the winning name, Electra, in a Green Mountain Power contest to name the talking cow in Rutland's new Energy Innovation Center. More than 170 children across Vermont suggested names.

"The Greek name Electra means sparkling, shining, bright or radiant," GMP President and CEO Mary Powell said. "We loved the name, because GMP Cow Power is ultimately derived from the sun. The sun helps farmers grow food for their cows, which in turn produce the fuel for cow power generation."

Jared, 8, said he chose the name Electra because of how it sounds. "I wanted to give her a girl's name that sounded like something to do with electricity," he said.

Dillon, 9, said he came up with the name in a similar way. "I chose Electra for the cow's name because it reminded me of electricity," Dillon said.

For suggesting the winning name, chosen by a panel of GMP employees, Jared and Dillon won ice cream parties for their entire classes. Jared,



Jared McGee, a student at West Rutland Elementary School, and Dillon Brigham, a student at Danville School, both named EIC's cow for their exhibit.

who is in Kathy Turgeon's West Rutland third-grade class, toured the EIC on January 23rd with his classmates, who then feasted on Wilcox Dairy ice cream in GMP's Innovation Workshop, a glass classroom, meeting room and collaborative space



Electra, a 7' long, talking cow built by the Imagination Company in Bethel, is the centerpiece of a Cow Power exhibit at the EIC. Photo Credit: Green Mountain Power

within the EIC.

Dillon, a student in Barbara Hawley's Danville fourth-grade class, also toured the facility and took part in the party, while his classmates in Danville enjoyed one at school at the same time.

Electra, a seven-foot-long, talking cow built by the Imagination Company in Bethel, is the centerpiece of a Cow Power exhibit at the EIC. One of 12 exhibits, it is designed to engage young and old alike, and is already a visitor favorite.

"Electra is doing exactly what we hoped she would do – engage visitors to help them learn about energy and the environment," said Steve Costello, GMP's vice president for energy innovation and customer service. "From young children to adults, she's helping make a complicated subject simple, and getting people to think not only about Cow Power, but other renewables as well."

Green Mountain Power's Energy Innovation Center is located at 68-70 Merchants

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## TOXIC TEAS?

# OH NO!



Photo: Laurel F from Seattle, WA (Tea) via Wikimedia Commons

On a recent visit to my son's home, my daughter in law asked me not to put my OG tea bags in the bucket for the worm composting. Their own experience of finding little pieces of plastic in their compost led to an eye opening discovery. The plastic was coming from the tea bags!

My research found this to be true, along with some better news. Read the following article written by Jamie Kiffel-Alcheh for Clean Plates\*.

By Jared Koch

So many of us enjoy relaxing with a hot cup of tea. Tea leaves have been shown to reduce the risks of cancer, heart disease, Alzheimer's and Parkinson's, and also to help lower cholesterol, and improve mental focus. But it turns out that some tea bags aren't so heart-warming.

Certain ones are treated with epichlorohydrin, a plastic that helps to keep the bags from breaking. The problem is that epichlorohydrin can potentially break down in water...and be released into your drink. The EPA says drinking water with high levels of epichlorohydrin, over a long period of time, could cause stomach problems and an increased risk of cancer. For perspective: The EPA allows up to 20 parts per million in drinking water, and epichlorohydrin-containing tea bags may include 50 parts per billion. Although the EPA's stated current goal is zero parts, you can continue to enjoy these toxin-free teas:

These bagged teas are all free of epichlorohydrin, as well as pesticides and artificial flavorings:

Numi Tea confirms, "Our teas are pesticide-free and non-GMO verified, and our tea bags are made from manila hemp cellulose, and free of epichlorohydrin. The tags are made from 100% recycled material and soy-based inks."

Rishi Tea's certified organic teas are bagged with PLA—polylactic acid, creating "silken" bags. Unlike other "silky" bags, which can be made with PET plastic, these are corn and potato starch-based. Tea Buyer Jeff Champeau confirms "Our Natural Fiber Loose Leaf Tea Filters are made without glue or any other binding agent."

EDEN Organic's company rep Wendy Esko confirms, "The bags are made from oxygen washed manila fibers with no polluting whiteners used. Once filled, the bags are crimped and sealed with 100% cotton string. No staples, plastics, or glue are ever used."

Organic Stash's website explains that "The filter paper used for Stash Tea bags is

made from 100% cellulose fibers (wood) and is made to appear white by forcing air between the fibers. No bleach is used. The filter paper is not coated with the compound called epichlorohydrin, and does not contain any free epichlorohydrin."

Choice Organic Teas company consumer relations expert, Nia, assured Clean Plates that all Choice Teas are not only organic but free of epichlorohydrin.

Two Leaves organic tea's company rep states "We pride ourselves on being pesticide-free as well as on having corn-based tea sachets." The website adds, "Our sachets are made of biodegradable cornstarch based nylon, not petroleum based nylon."

Organic Tazo. "We've checked with our teabag suppliers," says a spokesperson for Starbucks (Tazo's owner), "and they have confirmed that the only teabags we sell (our Tazo sachets or paper filterbags) do not use epichlorohydrin."

Organic Traditional Medicinals confirmed that this brand is epichlorohydrin-free. From Traditional Medicinals' website: "Our herbal teas are put into unbleached tea bags made from abacá (Musa textilis), also sometimes known as manila hemp. The tea bags are attached with aluminum staple wire to teabag string made of raw cotton (Gossypium spp.) and a paper tea tag."

Organic Yogi Tea's rep confirms, "We currently use a non-heat sealable filtration paper made from a select blend of high quality manila hemp (abaca) fibers and wood pulp. The filtration paper does not contain epichlorohydrin, nor plastic or polypropylene. It is oxygen bleached using a natural process that is completely free of chemicals or toxins, including dioxin."

Tetley Black & Green tea. Tetley's new Black & Green (a blend of both varieties) uses Perflo paper bags, which are free of epichlorohydrin. The tea is also free of pesticides.

And then, straining your own organic loose teas, well -- that's safe-tea.

About Clean Plates: Jared Koch is CEO, creator and co-author of Clean Plates, the only nutritionist and food critic approved guide to the healthiest and most sustainable restaurants in New York. Jared believes in and shares how to live a conscious, healthier lifestyle through education, inspiration, resources, and support at [www.cleanplates.com](http://www.cleanplates.com).

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# ASK THE SOAPMAN

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## DANVILLE, WEST RUTLAND STUDENTS ELECTRIFY TALKING COW'S NAME

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Row in downtown Rutland. The EIC houses GMP's generation development and energy innovation team and related staff, as well as Efficiency Vermont and NeighborWorks of Western Vermont staff, who are collaborating on customer-focused programs and ideas with GMP.

Teachers interested in scheduling a visit

and tour of the EIC, which uses a variety of super-efficient technologies and on-site solar and wind generation, may email [eic@greenmountainpower.com](mailto:eic@greenmountainpower.com).

About Green Mountain Power. Green Mountain Power ([www.greenmountainpower.com](http://www.greenmountainpower.com)) transmits, distributes and sells electricity in the state of Vermont. The company, which serves more than 250,000 customers, has set its vision to be the best small company in America.

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## TOXIN-FREE CLEANING SOLUTIONS FOR A HEALTHY HOME

By Clare Innes

Why do we all spend time cleaning? Many reasons come to mind, including safety. It's just not safe to allow dirt and other messes to accumulate. But if you use toxic cleaners, doesn't that negate the whole reason you're spending all that time scrubbing away? When you use household products that have words like Warning! Danger! Poison! Caution! you might want to keep that toxic Pandora in her container and turn instead to alternatives.

These days, those alternatives are readily available. You can even check them out by viewing the consumer guides at the Environmental Working Group website (<http://www.ewg.org/consumer-guides>). Even better, you can make 'em yourself! That way you'll know exactly what's in that bottle. Here are some suggestions.

Add 1 to 2 cups of vinegar to the rinse cycle to deodorize and soften fabrics.

Use equal parts vinegar and cool water to remove tough stains and clean mold and mildew from tub and tile areas.

Make your own bathroom tub and tile cleaner: 1-2/3 cup baking soda; 1/2 cup liquid soap; 2 tablespoons vinegar; 1/2 cup water. Mix soda and soap. Then add water. Then add vinegar. Rinse thoroughly after use to avoid leaving a residue.

Make an antiseptic soap spray that won't kill the good microbes: 3 tablespoons liquid soap, 20 to 30 drops tea tree oil, 2 cups water. Mix in a spray bottle and apply.

Need a little air freshener? Dissolve 10 to 20 drops of essential oil in a tablespoon of rubbing alcohol. Add a cup of water and mix thoroughly. Pour into an atomizer bottle or spritzer bottle.

Silver cleaner: use an old toothbrush and rub on some non-gel toothpaste. Voila! No more tarnish.

Deodorize your carpet by mixing a one-pound box of baking soda with a teaspoon of your favorite-smelling essential oil. Use a fork to work out the lumps. Sprinkle on the carpet. After an hour, vacuum as usual.

Drains can become smelly after a while. Freshen them by pouring 1/2 cup of baking soda down the drain, followed by 1/2 cup of vinegar. Let it bubble for 15 minutes, and then pour down a full teakettle of boiling water.

When your garbage pail just won't let go of smells, mix a teaspoon of tea tree oil with 1 cup of baking soda. Mix with a fork to get rid of the lumps. Sprinkle in the bottom of the pail after the liner is removed. Periodically rinse the pail with vinegar and water and dry in the sun.

Clare Innes is the Marketing Coordinator, Chittenden Solid Waste District. E-mail: [info@cswd.net](mailto:info@cswd.net), Hotline: 872-8111.

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# Green Tips

By Deborah DeMoulpied, Bona Fide Green Goods

## INDOOR ALLERGENS - TIS THE SEASON

Winter time allows us the opportunity to bundle up inside, relax, and cozy up to a nice blazing fire. A time when the windows are closed, the doors are shut and drafts are kept to a minimum. And a time when indoor air quality plummets.

This time of year many people have difficulty with indoor allergens. Sometimes chemicals build up and act as allergens – from carpets, perfumes, solvents, upholstery or paints. Other allergens come from pet hair, molds, cockroaches or dust mites. Some people will say they are allergic to dust, but it is really the dust mites and the enzyme they excrete that is the culprit in the allergic response.

Dust mites are tiny little things that love warm, moist air and feed off humans' and animals' dead skin. It is probably impossible to really get rid of them but certain precautions can keep them under control enough to minimize symptoms. Even pets can be allergic to dust mites!

Getting rid of them as much as possible and minimizing their food source is the best way to tackle the problem. Dust mites die at 135° F so a hot wash or dry should kill a lot of them. Low moisture

also makes their life miserable enough so that they may perish – below 50% humidity. Freezing is another option which is easy to do this time of year. Take the old stuffed animals and pillows and put them on the porch for over 24 hours and that should do them in.

Here are some general tips for keeping your air cleaner and reducing allergic reactions:

Vacuum frequently – use at least a HEPA filter; a central vacuum is ideal.

Keep humidity at 30-50% to prevent mold and mites.

Wash bedding regularly in hot water; soaking for at least an hour. Or, dry in hot heat. (For you environmentalists, you can hang dry first, then dry for only 10 minutes to kill the mites.)

Avoid fragrances or perfumes from personal care products, laundry soap, or candles.

Put dust

collectors and pillows outside for over 24 hours in below freezing temperatures.

Use a wet mop instead of a broom, a damp cloth instead of a feather duster.

Cover mattresses and pillows with dust mite covers.

Now breathe deeply!

Deborah DeMoulpied is owner and founder of Bona Fide Green Goods, an earth-friendly department store in Concord, NH. [Bonafidegreengoods.com](http://Bonafidegreengoods.com) won the Webby Awards Green Honoree in 2011. Deborah is also faculty of the Anticancer Lifestyle Program, teaching patients about environmental toxins and healthful solutions.



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## SNOWBOARD SUSTAINABILITY: MADE IN VERMONT

by Roger Lohr

Burton Snowboards in Burlington, VT is working to make snowboarding sustainable well into the future. Burton is the dominant snowboard product company, and this commitment to sustainability can be an example for other businesses in the snow-sports world to emulate.

Two fronts for sustainable efforts include an environmental focus on the full impact of Burton's operations such as product design, development, manufacturing, packaging, and shipping, and a social focus on the people who support Burton, including factory workers, employees, dealers, riders, and communities.

The environmental focus is generally known in the world of business where each decision takes root with an eco-influence. Since 2008, Burton has focused on improving not just the use of sustainable materials, but the process as a whole. From the production of snowboards and outerwear to luggage and apparel, Burton incorporates a sustainable perspective everywhere possible.

For example, recycled plastic bottles are transformed into pellets spun into thread to create fabric. The bluesign Restricted Substance List has been applied across all Burton factories and product teams are working to get as many bluesign-approved fabrics as possible into Burton lines in future seasons.

In 2012, Burton unveiled an enhanced manufacturing code of conduct and an extensive restricted substances list associated with the company's finished goods

factories and key materials suppliers.

Audits of Burton suppliers are now being conducted to evaluate and address Burton's social and environmental compliance with applicable global regulations and industry "best practices." A social compliance policy is in place that ensures contracted factories uphold Burton's standards and meet targets for continuous improvement, and supplier contract clauses deal directly with working conditions.

Ali Kenney, Burton's global sustainability director commented "We're seeing great progress throughout our supply chains. We've been able to reduce packaging dramatically, we have factories all over the world collaborating with us on an environmental facilities assessment, and we even have factories coming to us with new ideas around sustainability." Burton has also included an employee-run environmental committee dubbed EPIC (Environmental Protection, Integrity, Conservation) that focuses on fun ways to improve the company's impact on the environment.

Burton has placed in the top two spots in the Vermont alternative-commuting challenge and has received the silver ranking for a Bicycle Friendly Business by a national bicycle organization. The facility has showers, a secure bike shelter called "The Wheelhouse" and 15 loaner bikes for anyone to use around town. Community-building experiences, like free bagels for alternative commuters, group rides to work, and an annual competition for the most creative commute encourage, green



"The Wheelhouse" is a secure bike shelter with 15 loaner bikes for anyone to use around town.

Photos courtesy of Burton Snowboards

They've also partnered with a local company that supplies locally made organic hand soaps to employees.

Other social mores include bringing dogs to work, casual dress and flex Fridays in the summer (they get to leave at noon!), and a free pass to a local mountain for unlimited

commuting. A partnership with the local transportation agency offers free bus passes to all employees. Carpoolers get preferred parking with the slogan "Two or more, closer to the door. Carpool, fool!"

There are 18 composting and recycling stations throughout Burton's headquarters and a group sorts through all of it to determine the progress toward zero waste and educate employees. Organic vegetable plots are available on site for employees, who want space to grow their own. More than 6% of all employees tend plots.

In the mornings, Burton employees are offered complimentary organic fruit from a local food co-op and organic coffee and espresso from a Vermont coffee roaster.

snowboarding. Burton also offers fitness membership reimbursements to make staying healthy affordable.

Burton's Women's Leadership Initiative programs help to attract, retain, and promote women, increasing the number of women in leadership and influential positions throughout the organization. There are educational and social events for women throughout the year, like learn-to-surf outings, women's ride days, learn-to-skate nights, and career development workshops.

For more info on Burton Snowboard's commitment to sustainability, see [www.Burton.com/sustainability](http://www.Burton.com/sustainability)

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