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## Affordable POWER FOR NH

By George Harvey

Headed by Lori Barg, Community Hydro focuses on hydro-power in New England. While the company has produced a fair amount of information on hydro, analyzing data and issuing reports on resources available in the area, it has developed some hands-on expertise.

The latest big splash is in Antrim, New Hampshire, where it has redeveloped a site of its own. After using a bit of capital to buy an existing site that was not producing any power, the team invested sweat equity to get the dam back into operation generating power, and online. This happened in January of this year.

The Steels Pond Hydro dam in Antrim, New Hampshire will ultimately generate 900 kilowatts (kW) of power. For now, it is capable of delivering 300 kW; turbines for the remaining 600 kW have not yet been installed. The developers are looking to deliver three million kilowatt-hours per year, or more.



The Steels Pond Hydro dam in Antrim, New Hampshire will ultimately generate 900 kilowatts (kW) of power. Photo courtesy of Lori Barg.

Now, they are looking for buyers of the power they produce. Readers of Green Energy Times can refer to their advertisement on page 15. They would prefer to sell to schools, municipalities, nonprofits, or other organizations of similar size. Their hope is to enter into a group-net-metering contract with one or more customers of Public Service of New Hampshire. Under a long-term contract, a producer can benefit from getting a price above wholesale, and the customer benefits from getting a price below retail. Their hope is to have the contract by April.

The Steels Pond Hydro dam was one of hundreds of dams in New England that are not producing power. In most cases, the permitting is the single largest hurdle to having a hydro-electric facility operating where there is none today.

Lori Barg has authored a number of articles on small-scale hydro projects that can be developed in the area. She has been at this for a long time, and the materials she has produced are, in some cases, several years old. We should point out, however, that nearly all of the information provided

cont'd on p. 15

## Weatherizing the Statehouse

By Allan Bullis

This is a story on one of the most unusual weatherization projects in the State of Vermont. Starting two years ago, State Architect Tricia Harper contacted me at Common Sense Energy (CSE) to develop a plan to weatherize the statehouse as they had done in the past for other historic State buildings.

The Statehouse was built in 1838 and rebuilt after a devastating fire in 1857. The core building is the house chamber with wings to east and west. The statehouse got additions in 1888, 1900 and 1987. It was decided to approach the upgrades in a phased approach with the first phase focused on the east and west wings of the main building. This was completed in December, and the second phase is to be done this summer.

There are three discrete attics, all of which were poorly insulated. Making matters worse, there was mechanical equipment and ductwork located in the attic; this is very undesirable because it is outside of the thermal envelope. Only the attic flat areas had insulation, and they only had two inches of blown fiberglass, for an insulating value of R-6. The numerous vertical transition areas where ceiling heights change had no insulation.



Weatherization of the 1857 Statehouse was one of the most unusual projects in the State of Vermont.

Other complications included the presence of asbestos in part of the attic space. Insulation had to be removed in both wings using an industrial vacuum by contractors certified to work with asbestos remediation. Other work that needed to be performed before insulation work was completed included installing catwalks for maintenance work, upgrading the fire

detection system, repairing and sealing ductwork, adding insulation on ducts, and general maintenance.

Getting this all accomplished so the weatherization work could be completed before the current legislative session took a tremendous effort by Peter Hicks and Tricia Harper on the Buildings and General Services staff, CSE, cont'd on p.27

## GOODBYE VERMONT YANKEE

We're doin' fine...

By George Harvey

The reaction of some to the final shutdown of the Vermont Yankee (VY) nuclear plant was predictable. One national investment publication focused on the factoid that Vermont had lost 70% of its electric power. Notice, I said "factoid." A factoid is something that looks like a fact, but likely is not.

VY never supplied the state with 70% of the power it used. It produced about 70% of the power generated in Vermont, but it always sold most of that power out of state. At one time, the amount purchased in Vermont was about 35% of the state's needs, or about 1950 gigawatt-hours (GWh) per year. Recently, the state found that other sources were less expensive, and none of the power used in Vermont was purchased from VY.

The story of where Vermont does get its power is getting more interesting – and more exciting – with passing time. Back in 1997, Vermont started pursuing distributed, renewable power when it passed its net-metering law, which allowed consumers to produce power for the grid. This got the state off to a start and made people more aware.

Then in 2006, the state adopted its Sustainably Priced Energy Development (SPEED) Program, which is open to many different types of utility-independent power plants. Over the years, it has come to include fifteen bio-digesters, the greatest number in any state. It also includes solar farms, hydroelectric projects, wind farms, landfill methane plants, and biomass plants. They range in size from tiny to utility-scale.

Plants in the SPEED program are owned by a wide variety of companies, cooperatives, farms, schools, organizations, and households, but even in combination with net metering, they do not represent all the renewable power installed in Vermont by any means. Renewable generation owned by utilities is not included in either program.

It is easy to find out how much power is generated under the SPEED program by visiting the web page, vermontspeed.com/project-status. The seventy or so projects produce over 892 GWh per year. If we guesstimate net-metering at about 50 GWh per year, the combined output of the two programs is about 940 GWh per

year. When VY shut down, Vermont's SPEED and net-metering programs had already replaced nearly half of the power the state once got from the nuclear plant.

It might be useful to make a few observations about this.

Detractors of distributed and renewable power love to point out that wind and solar systems are intermittent. Truth be told, all sources are intermittent, and utilities have always had

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"Vermont's renewable energy programs have already replaced nearly half of the power the state once got from VY."

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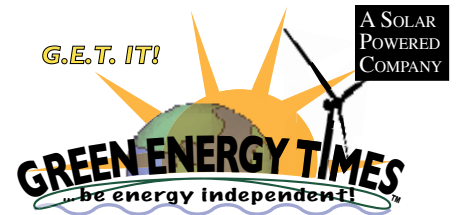
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**Our mission is to create Energy Awareness, Understanding and Independence - Socially Responsible Living.**

**Solar Power works! ... anywhere! under the sun!**

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# Top Energy News Stories of 2014

*These stories, for which links can be found on the internet at [www.greenenergytimes.net/top-20-of-2014](http://www.greenenergytimes.net/top-20-of-2014), were chosen by the editors of Green Energy Times as the top twenty of 2014:*

## January 11:

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

**January 16:** Lawrence Berkeley National Laboratory and University of Connecticut analyzed more than 122,000 home sales near 26 wind facilities in densely populated Massachusetts, yet was unable to find any impacts to nearby home property values.

**February 11:** Decommissioning Sellafeld nuclear power station in the UK will cost taxpayers at least £70 billion (\$106 billion) as costs hit "astonishing levels," senior MPs said yesterday. "What's worse is that the cost is likely to continue to rise."

**March 7:** China's Premier Li Keqiang has declared war on pollution, outlining significant steps the Chinese government will take to improve air quality. China has suffered from truly epic smog over the last two winters.

**March 19:** Available evidence does not support the notion that wind farms cause adverse health effects, according to the Australian Medical Association. They say health effects blamed on wind turbines are instead a placebo effect caused by anti-wind activists.

**March 25:** In new estimates released today, WHO reports that in 2012 around 7 million people died - one in eight of total global deaths - as a result of air pollution exposure. This confirms that air pollution is now the world's largest environmental health risk.

**May 3:** According to the International Monetary Fund, when you factor in implicit subsidies from the failure to charge for pollution, climate change and other externalities, the post-tax cost of support for fossil fuels comes in at close to \$2 trillion each year.

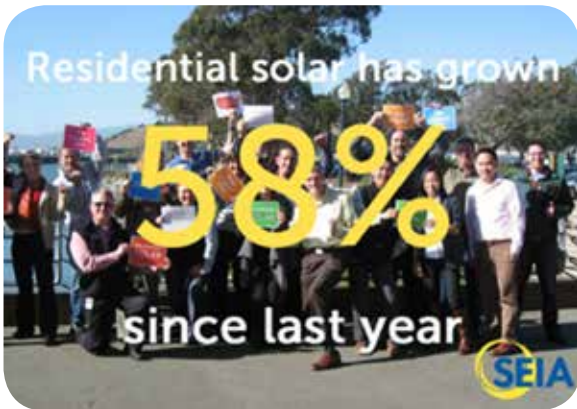
**June 10:** A decision by parties to an obscure convention has huge implications for Europe's aging nuclear reactors. License extensions for nuclear reactors have environmental impact assessments comparing impacts to those of renewable alternatives.

**June 26:** The use of executive powers to regulate greenhouse gas emissions has been reaffirmed by the US Supreme Court in a ruling issued on Monday. This suggests President Obama's climate policy has solid legal foundations.

**July 7:** On July 5 and July 6 in Oklahoma, there were seven earthquakes. As of last month, Oklahoma had surpassed California in the number of earthquakes. It's possible that hydraulic fracturing, or fracking, could have played a role in causing them.

**July 29:** The American Wind Energy Association has just come out with some facts and figures about the so-called hidden cost of wind power. According to the AWEA calculations the "hidden cost" for conventional power plants in Texas is 17 times more than wind.

**August 19:** A Department of Energy and Lawrence Berkeley National Laboratory report pegs utility-scale wind power-purchase



agreement pricing as averaging \$25 per MWh for projects that negotiated contracts in 2013. That makes wind the lowest cost power source.

**August 28:** Renewable energy sources accounted for 14.3% of net US electrical gen-

eration in the first half of the year, according to a new report by the EIA. Last year, the EIA forecast that the US would reach the 14% renewable mark in 2040.

**August 31:** One of the most important pieces of news of the summer made virtually no headlines and seemed to only appear on the website of the US Energy Information Administration. 127 of the world's largest oil and gas companies are running out of cash.

**September 7:** The transition to a global renewable energy economy could save \$71 trillion by the year 2050, according to an IEA report. Put another way, \$44 trillion in investment by the year 2050 would translate to about \$115 trillion in energy savings.

**Sept. 14:** After a seven-year-long investigation, scientists at the National Audubon Society issued a grim report finding that more than half of the 650 or so bird species in North America may be threatened by global warming.

**September 19:** Ahead of a UN climate summit, institutional investors managing £15 trillion of assets are calling on governments to phase out subsidies for fossil fuels, which are estimated at £370 billion per year world wide, five times the subsidies for renewables.

**November 12** - The presidents of the US and China agreed to reduce greenhouse gas emissions in both countries. The US would cut its carbon emissions by 26-28% before 2025. China would start to cut carbon emissions and be 20% carbon free by 2030.

**December 1:** EON, the world's largest investor-owned utility, will break itself up, spinning off fossil fuel power plants into a separate company so it can focus on renewable energy. EON will write down the value of assets by €4.5 billion.

**December 30:** The Vermont Yankee nuclear power plant stopped sending electricity to the grid Monday after producing total of 171 billion kWh over its 42-year lifetime. The shutdown came just after noon as the plant completed its 30th operating cycle.

**APRIL ISSUE:** We will be featuring five local communities that are making exemplary strides towards resilient sustainability. If you are from Montpelier or Rutland, VT, Keene or Plymouth, NH, or Greenfield Center, MA, and have somethin to share or to include, please contact us immediately via email: [info@greenenergytimes.org](mailto:info@greenenergytimes.org) or 802.439.6675.

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*Energy Awareness, Understanding & Independence!*



# Vermont's Legislative Landscape for Clean Energy & Climate Action

By Johanna Miller

The Vermont Legislature is exploring a couple of big energy bills that would redouble Vermont's commitment to reducing fossil fuel consumption and help Vermonters transition to renewable resources.

One bill primarily targets the electric sector. There is also an effort afoot to tackle the state's two largest greenhouse gas emitting sectors – heating and transportation – by putting a price on carbon pollution.

Here's an update on, and brief overview of, these two big energy and climate-change-related proposals and their potential prospects under the Golden Dome.

**H.40 and S.51** – Establishing a Renewable Energy Standard and Energy Transformation Program

Both the House and Senate are considering bills that would replace Vermont's SPEED program, which is set to expire in 2017, and enact a Renewable Energy Standard. The "RESET" program, as it is being called, will require utilities to meet a certain percentage of their electricity sales using renewable energy. For many, this is an essential transition away from Vermont's current, controversial program, which has allowed utilities to sell the Renewable Energy Credits in the New England REC market (the trade-able, "green" attributes generated by solar, wind, etc. in Vermont) as well as count those projects toward Vermont's own renewable energy goals.

This "Total Renewable Requirement" – 55% of sales in 2017, rising to 75% by 2032 – will eliminate any further double-counting by requiring the retirement of renewable credits. It will also help get more renewable energy built in Vermont and the region. Putting Vermont on par with the majority of the nation's 50 states is only a piece of this proposal, though. The innovative element of the proposed legislation lies in the additional support given to small-scale renewables, energy efficiency and transportation innovation.



The second tier – "Distributed Generation" – mandates that utilities meet a percentage of their annual electricity sales – one percent in 2017, rising to 10% in 2032 – through community-scale (five MW or less) renewable projects, such as community solar or combined heat and power systems. The provision is aimed at continuing to spur small-scale renewable energy generation that communities often support and that benefits ratepayers through deferral or avoidance of transmission upgrades and reducing high-priced peak-power purchases.

The third tier is the particularly innovative element. The "Energy Transformation" tier is a requirement that utilities support fossil fuel reduction

solutions in the heating and transportation sectors – two percent of annual sales (in BTU equivalency) rising to 12% in 2032. This tier intends to foster new, creative projects and partnerships that reduce fossil fuel consumption. It aims to catalyze more comprehensive energy approaches, supporting investments in weatherization, cold-climate heat pumps, electric vehicle or ride-sharing solutions and far more.

Beyond the RESET legislation, which has strong support from the Public Service Department, utilities and advocates, there are also a couple of bills to push Vermont to tackle the state's biggest greenhouse gas emitters – heating and transportation. The goal? Put a price on carbon pollution.

A growing coalition of business, academic, environmental and low-income advocacy groups – called Energy Independent Vermont – are working with lawmakers to explore Vermont enacting a carbon pollution tax.

Advocates, including Vermont Natural Resources Council, have undertaken a tremendous amount of research – including an independent economic analysis – to understand if such a policy would be good for Vermont. The conclusion: Vermont could enact a policy that 1) significantly reduces global-warming pollution, 2) does so in way that grows jobs and our economy and 3) mitigates the impact to low-income Vermonters.

The Energy Independent Vermont coalition's plan is to return 100% of the proceeds from the tax back to Vermonters. A full 90 percent would go back in direct tax rebates or tax relief and 10 percent into an energy independence fund that Vermonters could tap to help them reduce their fossil fuel use and save money.

Here's why it works: Vermonters now spend nearly \$2 billion on fossil fuels each year, with nearly all of that money going directly out of Vermont and into the pockets of companies like Exxon Mobil. Putting a price on carbon pollution will keep millions more dollars in state thereby growing our economy, creating needed jobs and otherwise stimulating local economic activity. That will keep more money in Vermonters' pockets to spend on groceries or going out to dinner – instead of on their heating bills.

The plan would also be implemented gradually, over 10 to 15 years, so Vermonters would have time to adjust and take advantage of the economic incentives the policy would create to reduce their heating and transportation costs.

A Vermont carbon pollution tax could be a big win for people's pocketbooks, and the planet.

But it won't be easy. A policy like this won't be enacted overnight. It will take time to demonstrate how this policy will work, and how it will benefit all of us. The goal this session is to begin to shape the best policy, and move the ball forward.

For more information about Vermont's campaign to enact a carbon pollution tax, or to get involved, visit [energyindependentvt.org](http://energyindependentvt.org) or contact VNRC's Energy Program Director Johanna Miller at 802-223-2328 ext. 112 or [jmiller@vnrc.org](mailto:jmiller@vnrc.org).

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Above: Solar barn. Photo courtesy of Johanna Miller.  
Bottom left: Solar education site at the former CVPS location on Route 7, north of Rutland, Vermont.  
Photo: flickr/ IBEW Local 300

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# Is an Electric Car Right for You?

By Gina Coplon-Newfield

A lot of people have heard the buzz around electric vehicles (EVs), but they don't know if an EV would be right for them. In fact, many don't even know what would be the right questions to ask themselves to figure out whether cars like the Tesla Model S, Nissan Leaf, Chevy Volt, or Ford C-Max Energi would fit their lifestyles -- not to mention their budgets.

The Sierra Club has launched a 'pick-a-plug-in' web tool to help people figure out which electric cars, if any, are right for them.

There are a lot of compelling reasons why more than a quarter million Americans have already bought EVs since they first came on the mass market a few years ago. They are cool high-tech wonders (imagine driving an iPhone!), there is little or no need to ever visit a gas station (depending on whether you purchase a full battery electric or a plug-in hybrid car), they are much cheaper to fuel (the equivalent of about \$1 a gallon), and they are much better for the environment (even considering the electricity to charge them up).

Also, there is a \$2,500 to 7,500 federal tax credit that comes with the purchase of an EV. And many people live in cities and states where they can take advantage of additional incentives, like a purchase - lease rebate (in some places get a check for thousands of dollars!), carpool lane access, and special utility rates for EV drivers. Linked to their new 'pick-a-plug-in' web tool is an online EV Guide that has all of

this information if you enter your zip code. If you click on a specific EV, we'll even tell you how much you'll avoid in carbon emissions and fueling costs compared to the average conventional car.

A poll last year found that nearly half of American households could purchase an EV for their next car; it would be a great fit for their driving needs, and they would have a place to charge it with electricity. We're talking about many millions of people. Are you one of them?

But are EVs currently the right fit for everyone? No. For example, some people don't have a place to charge them with electricity. For many, though, it's simpler than they think. I had a basic 110 volt outlet installed on the side of my house, so I can charge up my car in our driveway. Easy peasy.

Many people ask, "What's the best electric car to get?" The answer is always, "it depends." How many miles do you drive in a typical day? Do you take a lot of long-distance trips? How much money are you willing to spend? There are nearly 20 great models available in the US and more coming out every year.

So, what are you waiting for? Check it out at <http://content.sierraclub.org/evguide/pick-a-plug-in>.

-- Gina Coplon-Newfield is Sierra Club's Director of Future Fleet & Electric Vehicles Initiative

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source: [www.nissan.com](http://www.nissan.com)

## NISSAN LEAF

115 MPGe - 84 miles/charge - All Electric \$21,300-\$27,340 (after \$7,500 federal tax credit).

## TESLA MODEL S

95 MPGe - 265 miles/charge - All Electric \$62,400-\$72,400 (after \$7,500 federal tax credit).

## CHEVROLET VOLT

98 MPGe - Plug-in Hybrid \$27,510 (after \$7,500 federal tax credit).

## FORD C-MAX ENERGI

100 MPGe - Plug-in Hybrid \$28,463 (after \$4,007 federal tax credit).

## FORD FUSION ENERGI

100 MPGe - Plug-in Hybrid \$30,835 (after \$4,007 federal tax credit).

## BMW i3

124 MPGe - 81 miles/charge - All Electric \$34,800 (after \$7,500 federal tax credit).

## MERCEDES B-CLASS ELECTRIC DRIVE

84 MPGe - 87 miles/charge - All Electric \$34,875 (after \$7,500 federal tax credit).

## FIAT 500E

116 MPGe - 87 miles/charge - All Electric \$25,000 (after \$7,500 federal tax credit).

## HONDA ACCORD PLUG-IN

115 MPGe - Plug-in Hybrid \$36,944 (after \$3,626 federal tax credit).

## FORD FOCUS EV

105 MPGe - 76 miles/charge - All Electric \$22,495 (after \$7,500 federal tax credit).

## SMART FORTWO ELECTRIC DRIVE

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\*Note: Prices include MSRP plus destination charge.



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# New Hampshire Welcomes TESLA EVS



Tesla Model S charging at a Supercharger Network station. Photo: Steve Jurvetson, Wikipedia.

## Green Energy Times staff article

Driving a Tesla is getting easier in New Hampshire with the addition of new charging stations. A number have popped up at rest areas on major highways such as I-93. The charging stations in Hooksett are to have twelve stations for Teslas and six for other production vehicles.

Other public access charging stations are being installed in more places across New Hampshire. This is seen as an investment in the future of the state. The stations help make tourists who have electric vehicles (EVs) feel comfortable as they drive to or through the area.

Some businesses are also leading in installing charging stations. Hay Creek Hotels is offering drivers of Teslas and other EVs a chance to plug in while they spend the night or dine. All their properties, including four in New Hampshire, four in Maine, and one each in Connecticut, Massachusetts, Vermont, and Virginia, have been equipped with charging stations. Different types of charging units are being installed for different types of EVs.

Hay Creek Hotels has had an environmental focus since its inception, in 2005. The management of the chain has been very aware of a need for more charging stations, and by having them installed at the hotel properties, customers are provided an important amenity, and owners of EVs can have more enjoyable visits.

"We are proud to be able to offer this amenity to our travelers," Norman MacLeod, President and CEO of Hay Creek

Hotels, explained. "We continue to seek ways to surprise and delight our guests, and hope these charging stations make them feel at home, while providing us with an opportunity to contribute to the environment. We're pleased to be able to offer Tesla stations at so many of our properties." Noting that the management of Hay Creek Hotels is very aware of high-tech solutions that are environmentally friendly, especially when they can be of service to guests, he also said, "Additional electric charging stations will be available for all other electric vehicles as well."

The charging stations at the Hay Creek Hotels will be available throughout the year as a convenience for guests. Their locations will be programmed into the GPS systems of all Teslas.

The Hay Creek Hotels' charging stations can be found at the following locations:

- Ethan Allen Hotel, Danbury, CT
- Orchards Hotel, Williamstown, MA
- Beach House Inn, Kennebunkport, ME
- Breakwater Inn, Kennebunkport, ME
- Yachtsman Lodge & Marina, Kennebunkport, ME
- Eagle Mountain House, Jackson, NH
- The Exeter Inn, Exeter, NH
- The Wolfboro Inn, Wolfboro, NH
- The Centennial Inn, Concord, NH
- Oakhurst Inn, Charlottesville, VA
- Windham Hill Inn, Townshend, VT

More information on the Hay Creek Hotels can be found at [www.haycreekhoteles.com](http://www.haycreekhoteles.com)

# 2015 FUEL EFFICIENT VEHICLES

## Green Energy Times Staff

Every year we like to do a review of what good fuel-efficient vehicles are available. This year we started by asking Beth Bassett, communications director at Grappone Auto Group from Bow, New Hampshire.

GET: What, in your estimation, are the best fuel-efficient vehicles for 2015 and why?

Bassett: I don't think anything really compares to the Prius. I prefer the smaller and sportier Prius C which you can buy for under \$20,000! Then there is the traditional looking mid-size Prius Three and Prius Four which run in the mid \$20K range. We still have a lot of people that buy the Prius V Wagon for the added space and the great gas mileage of 44/City and 40/hwy.

Toyota also has the Prius Plug-in but they are VERY hard to find.

GET: We have heard good things about Fords. What about them?

Bassett: Ford is doing a great job of getting in the "fuel-efficient" arena. The Ford Fusion Energi is a gorgeous luxury sedan. Ya, it's a little pricey at \$30,000 but it is super roomy and a really sharp looking car. Plus, it's rated for 44/City and 41/Hwy.

More and more charging stations are popping up including at the new rest areas they built on I-93 in Hooksett. These 'quick charge' stations, like we have at Grappone, can charge this vehicle in just a couple of hours. Since we use solar panels to charge our charging stations, they are free to the public.

You can plug also plug it in when you get home at night (the cord comes with the car and runs on regular 110 volt) and it will stop drawing electricity once it's charged. The full charge gives you about 20 -22 miles of full electric operation. After that, it's full hybrid, meaning that it uses no gas at stops and regenerates electricity when you apply the brakes. How sweet is that?!!

GET: What do you think about the price of gas going down lately?

Bassett: Gas prices may be low right

now but you and I both know this is a temporary situation. I would certainly take advantage of the great deals right now and save even more.

◇◇◇

We felt two cars stood out in reviews at Popular Mechanics webpage. One is a 50-MPG Family Car, which can be found by visiting <http://bit.ly/PMBestCars4>:

2015 Honda Accord Hybrid Price: \$30,095; MPG (City/Hwy): 50/45

A driver who has only experienced gas-powered cars can get into a Honda Accord Hybrid and feel at home driving it. Its hybrid technology is not a distraction from the basic fact that the car is very enjoyable to drive. The electric motor delivers 166 horsepower, giving it a good deal of power. The 2.0-liter four-cylinder gas engine comes alive when it is needed and goes asleep when it can. When the



The 2015 Ford Fusion Energi

source: [www.ford.com](http://www.ford.com)

engine is off, the car is powered by its lithium-ion battery. One thing the driver might notice is that the car has a range of 750 miles between fill-ups.

The other car we noticed, which can be found at <http://bit.ly/PMBestCars12>, is the 2015 BMW i3; Price: \$42,275; MPGE (City/Hwy): 137/111

The BMW i3 is all about combining efficiency with comfort. To do this, it relies on advanced technology as a backdrop for a piece of automotive art. It provides the driver with a possibility of enjoying luxury without feeling guilty about an environmental impact.

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\*Based on 2015 EPA mileage ratings. Use for comparison purposes only. Your mileage will vary depending on driving conditions, how you drive and maintain your vehicle, battery-pack age/condition and other factors.

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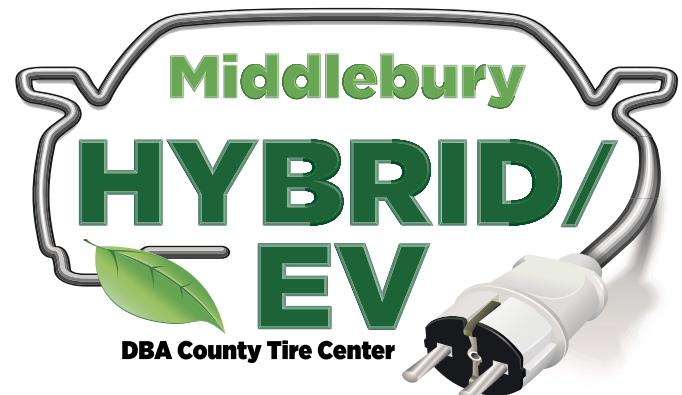
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# GREENHOUSE GAS EMISSIONS FROM TRANSPORTATION

By Thaddeus Rumple

Greenhouse gases (GHGs) trap heat in the atmosphere, making the planet warmer, as a whole. While some GHGs come from natural sources, almost all of the increase in greenhouse gases in the atmosphere over the last 150 years can be traced to human activities. The most important sources of GHG emissions from the United States are fossil fuels, which are burned for electricity, heat, and transportation.

GHGs are also removed from the atmosphere by human and natural activity. Human beings can encourage atmospheric GHG reductions by planting trees and encouraging other natural activities that remove them. Anything that removes them is referred to as a "GHG sink."

The United States Environmental Protection Agency (EPA) tracks total U.S. emissions, and publishes an annual report, the Inventory of U.S. Greenhouse Gases and Sinks, which can be found by visiting <http://1.usa.gov/1uAwSli>. This report provides the EPA's estimates of the total national GHG emissions and removals associated with human activities across the United States.

According to the EPA, 28% of the United States' GHG emissions were from transportation in 2012. The EPA says "Greenhouse gas emissions from transportation primarily come from burning fossil fuel for our cars, trucks, ships, trains, and planes. Over 90% of the fuel used for transportation is petroleum-based, which includes gasoline and diesel."

By comparison, 32% of GHGs released in the United States were from electricity production, mostly by burning coal and natural gas. But the electric sector was the only one that had GHGs exceeding those of transportation. Industrial production of GHGs was only 20% of the total. Land use and forestry accounted for 15%, agriculture for 10%, and commercial and residential heating for 10%.

The EPA has this to say of the transportation sector:

The Transportation sector includes the movement of people and goods by cars, trucks, trains, ships, airplanes, and other vehicles. The majority of greenhouse gas emissions from transportation are CO2 emissions resulting from the combustion of petroleum-based products, like gasoline, in internal combustion engines. The largest sources of transportation-related greenhouse gas emissions include passenger cars and light-duty trucks, including sport utility vehicles, pickup trucks, and minivans. These sources account for over half of the emissions from the sector. The remainder of greenhouse gas emissions comes from other modes of transportation, including freight trucks, commercial aircraft, ships, boats, and trains as well as pipelines and lubricants.

Motor vehicles are one of the greatest contributors to American air pollution.

Relatively small amounts of methane (CH4) and nitrous oxide (N2O) are emitted during fuel combustion. In addition, a small amount of hydrofluorocarbon (HFC) emissions are included in the Transportation sector. These emissions result from the use of mobile air conditioners and refrigerated transport.

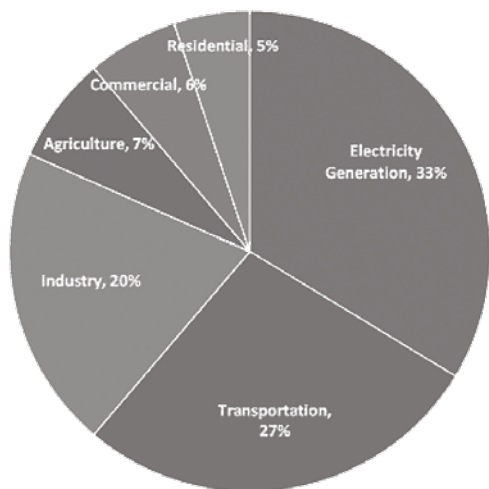
GHG emissions from transportation have increased about 18% since 1990. This is quite a lot less than increases in other sectors, which have seen GHG emissions grow by about 5% per year over the same time. Over the last few years increases in GHG emissions have started to slow down. In 2012, GHGs for the United States actually showed a decline from the previous year. Part of the decrease was because of a shift from coal to natural gas as a fuel for electric production. Mild winter temperatures in 2012 also played a part.

Now, there are some vehicle purchasers who consider the current low prices for oil and gas and are willing to buy vehicles with reduced fuel economy. The underlying facts of the market do not support the view that low prices can continue for long. Automotive companies are building increasing numbers of electric vehicles (EVs), and that will have a growing influence on transportation GHG emissions. General Motors, Ford, BMW, and Volkswagen have all said they will be producing EVs in greater numbers.

People who drive EVs are very much inclined to prefer them, according to reports. This is true whether the car is a Tesla Model S or the sub-compact Smart electric drive, a product of Mercedes-Benz.

One thing that we might mention is that driving an EV reduces GHG emissions only if the electricity used to charge the car is from sources with low EV emissions. An electric vehicle charged with electricity purchased from hydro, wind, or solar plants has very little in the way of GHGs associated with it. But an EV that is charged with electricity from a coal-burning plant could have GHG emissions no better than a car powered by gasoline.

Aside from using more fuel-efficient personal road vehicles, we can reduce GHGs by moving to other means of transportation. Buses, trains, bicycles, and walking are all often better choices, when they are possible.



## 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 car-pools, transit routes and schedules, bike and walk trails and links to statewide transportation information.

When carpooling, remember to use the local Park n Ride lots to meet your connections. Start your trip planning at [connectingcommuters.org](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, Poultney 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 [riderct.org](http://riderct.org)

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



# Tried, True & New POWER STORAGE OPTIONS

By George Harvey

We hear a lot today about power storage because of the increased use of solar and wind for generating electricity. The explanation for this is that solar and wind are intermittent – the sun is not always shining, and the wind does not always blow.

The fact is that all sources for power generation are intermittent; even nuclear needs to go offline periodically to be refueled, a process that usually takes a month or more. Also, baseload plants are inflexible and do not match grid demand well. For both reasons, utilities rely on special “peaking” power plants that are very expensive to run.

Power storage has been around for years, however. One option is pumped storage, that can provide huge amounts of power storage. The Northfield Mountain power station in Northfield Massachusetts, was installed to help match the output of the Vermont Yankee nuclear plant to grid demand. Its peak output was about twice the output of Vermont Yankee.

Other types of storage have been used as well. Recently, there have been attempts, many successful, to work with flywheels, thermal storage, compressed air, hydrogen, synthetic gas (power to gas systems), various kinds of capacitors, and others.

Deep-cycle lead-acid batteries have been the most common choice for household storage, and they see some use even for grid backup. The high-quality batteries from Rolls and Trojan Battery, for instance, use well-established technology. This fact that the characteristics of deep-cycle lead-acid batteries are well known means that knowledge about maintenance is well established. Rolls’ website is [www.rolls-battery.com](http://www.rolls-battery.com). Trojan’s website is [www.trojanbattery.com](http://www.trojanbattery.com).

Interestingly, another old design being revived is the iron-nickel battery. These use potassium hydroxide, a powerful alkali, as the electrolyte, with iron negative plates and nickel(III) oxide-hydroxide for positive plates. They are capable of withstanding a fair amount of abuse, including overcharging, over-discharging, and even short-circuiting, and have very long lives even under such circumstances. Iron Edison is a manufacturer, and it may be worth while to

check their web site, [ironedison.com](http://ironedison.com).

Some of the most interesting recent work has been with newer kinds of batteries. There are many of these, and some of them are very different from what most of us might imagine. We might look at four of these that seem promising.

Surely most of the readers of Green Energy Times have heard of lithium-ion batteries. What many of us have not heard of is sodium-ion batteries. Sodium is much more abundant than lithium, and also does not have some of lithium’s problems. The trouble with sodium is that the atom is rather large, compared to a lithium atom, and this results in the need for a larger battery for a given task. You will not find these helpful with a cell phone, but they can power the grid about as easily as the more expensive lithium-ion batteries. Aquion

Energy, of Pittsburgh, Pennsylvania is bringing such batteries to the grid. You can find more information at [www.aquionenergy.com](http://www.aquionenergy.com).

Flow batteries are being developed. In a typical flow battery, two electrolytes are pumped past each other with a membrane between them. Chemically, the action is very similar to the old lead-acid batteries in some ways, but the chemicals remain in solution for the entire process of charging and discharging. There is no reduction of quality over time, and the electrolytes can be discharged 100% on a daily basis

for years. There are many kinds of these being developed.

One flow battery comes from Imergy Power Systems, which has offices in Fremont, California and Haryana, India. This battery uses a vanadium-based electrolyte. Vanadium is expensive, but the people at Imergy found a way to recover it from fly-ash in such a way that it requires only slight purification. The result is a rather inexpensive flow battery that can be built in sizes suitable for a household to those supporting a large microgrid. There is more on this at [www.imergy.com](http://www.imergy.com).

Another flow battery comes from Harvard University. This battery uses a quinone compound that can be found in such natural places as rhubarb plants, in its electrolyte. This makes it much less expensive than those that use metals that may be in limited supply. The technology is very new, but the underlying science has been confirmed, and it is now getting tested in a pilot plant. The originators see the project as possibly transformative. There is no company website we can provide, but a web search, “Harvard quinone battery,” will yield news and articles.

One of the most remarkable solutions comes from Ambri, a company in Cambridge, Massachusetts. In this case, electrodes are made of magnesium and antimony. They are molten, *cont’d on p.11*

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Aerial view of the Ayer's Brook Goat Dairy PV in Randolph, Vermont. Photo courtesy of Aegis Renewable Energy.

## goats go solar

By George Harvey

The largest single rooftop solar array in Vermont was recently installed on a barn at Ayers Brook Goat Dairy in Randolph, owned by Vermont Creamery. Aegis Renewable Energy installed the system, which is capable of generating about 200,000 kilowatt-hours per year.

Aegis Renewable Energy is very diversified, as it uses a variety of technologies, and has customers over a wide geographical area. The firm does a lot of work on solar projects, but they also work with wind and anaerobic digesters. They were in the news recently because they installed the first commercial wind turbine in New York City. This was a double score for Vermont, because the turbine itself was manufactured by Northern Power Systems in Barre.

The story of how Aegis Renewable Energy connected with Vermont Creamery is worth telling. Nils Behn, the owner of Aegis Renewable Energy happened to be driving through Randolph when he

noticed a large barn under construction. "I realized at once that it was in a great location and was well oriented, so I decided to make a presentation. It ended up being a great project."

Behn does point out that he did some homework before he presented the idea of putting a solar photovoltaic (PV) system on the Vermont Creamery barn. Bob Reese, a co-founder of the Vermont Creamery, which owns the barn, was quite ready to listen.

Vermont Creamery has a reputation not only for being run by people with a genuine love of the work they do, but also for being very environmentally aware. That being the case, it is unsurprising that Reese had already been thinking about PVs for the barn roof. "We had always planned on renewable power," he explained. "The energy tax credit was something we had thought about, and we were aware of the value of the barn's south-facing roof." It is an ideal place to put solar PVs. Behn's design arrived at just the right moment, and the project proceeded rapidly.

Behn is particularly sensitive to the

need for preservation of agricultural land, so this was a project in which he could take pride. The barn's size, 21,000 square feet, made it possible to put up 572 solar panels on the roof, resulting a total capacity of 181 kilowatts. This provides power to the barn and creamery's cheese-making facility.

Bob Reese points out that Ayers Brook is a demonstration dairy, and the intention is to provide farmers with a model they can observe in action, so they can develop their farming practices. This is all the more important because farms in Vermont are increasingly investing in renewable power and sustainable production techniques. To date, over fifty farms in Vermont have developed renewable power to cover their costs, develop new income sources, and have their own local power.

Aside from Vermont Creamery and Aegis Renewable Energy, the winners on this project include Green Mountain Power, the people of Vermont, our children, our future, and the rest of everybody. *What a good deal!*



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# O'Meara Solar

## East Orange, Vermont

By George Harvey

Patrick O'Meara is a carpenter who has worked for many years doing fine wood-working of all types. His home is in an area of East Orange, Vermont that the electric grid never reached, so he had to install his own generating equipment for both it and the shop where he does his work. For years, the major source of his electric power has been his own array of solar photovoltaics (PVs).

The solar system was installed years ago, when solar prices were much higher than they are today. Even so, it was less expensive than bringing in grid power. In those days, solar was only exceptionally less expensive than grid power. Things have changed since then, and today it is the rule in much of New England that solar power costs less than grid electricity.

O'Meara's shop is a great example of what can be done with PVs. As a carpenter, he has a lot of power equipment, and he depends on it for his livelihood. Nevertheless, the shop is solar powered. There is a battery system, of course, for those times that the sun is not shining, and so the work can be done in a timely, professional manner, powered by the sun, regardless of whether the sun is shining or not.

Darren O'Meara, Patrick's son, grew up naturally interested in electricity. He took his degree in Electrical and Electronics Engineering, and became a semi-conductor engineer. When it came time for him to

have a home of his own, he wanted to live in the same area where he grew up, the same area without grid electric power. Of course, he put in his own off-grid solar system.

Since the O'Mearas had worked with their own PV systems, they naturally got requests for help, guidance, and advice from others who wanted their own systems. O'Meara Solar grew out of that demand.

Darren's experience with engineering is a nice complement to his father's with woodworking. Darren can do all the electrical engineering, including specifying makes and models of equipment that can be integrated into a system. Patrick has all the expertise they need to deal with custom roof mounts that work well with an existing building. Between them they have just about everything they need to design and install top-quality professional solar systems.

This is not to say that they do everything themselves. They subcontract things ranging from excavating for ground-mounted systems to electrical work, getting the benefit of workers with expertise in those types of work.

From the customer's point of view, this means that the system was designed by the same person who sold it, and the same person was responsible for details of the installation. It means that the company does the installation knowing that it will ultimately be responsible for how



the system performs. Darren points out that he hopes to maintain good relations with his customers for a long time. "We are small and local," he explains, "and I expect to be here for the rest of my life." For those who are interested, he is thirty-five, so he could be around for a good while.

The O'Mearas like to deal with local customers, and prefer to work on installations that are no more than an hour's drive away. Nearly all their work is in Orange County, Vermont and Grafton County, New Hampshire.

Since the O'Mearas live with their own off-grid systems, they understand such



Photos courtesy of Darren O'Meara

installations and do a lot of them. They also do grid-tied systems, including both those with and without battery backup. Roof- and ground-mounted systems are both well within their abilities. Examples of their work can be seen at their website, [www.omearasolar.com](http://www.omearasolar.com). 802-522-2381.



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# PLYMOUTH VILLAGE WATER & SEWER SOLAR

By Green Energy Times Staff



A new solar array belonging to the Plymouth Village Water and Sewer District (PVWSD) began producing power in December. It was built with the help of a coalition of a large number of people and organizations. As the second largest solar array in NH Electric Co-op territory, it provides a model for other groups who might wish to work together on a similar goal.

The project started in 2012, when the PVWSD started looking into ways to reduce costs. Officials there turned to the Plymouth Area Renewable Energy Initiative (PAREI) and New Hampshire Electric Cooperative (NHEC) for help.

PAREI and PVWSD worked together to get a \$317,000 grant from New Hampshire's Renewable Energy Fund, which is administered by the NH Public Utilities Sustainable

Energy Division. The initial application was made in 2012, and the grant was awarded on their second go-around in December of 2013 with a completion goal of December 2014.

The next step was getting the right people involved. PAREI put its expertise to use on this part of the project. "We put together an outstanding team of solar installers to get the work done and the staff at the Water and Sewer Treatment Plant assisted with some of the prep work too," Sandra Jones, Director of PAREI, explained. "It's been a wonderful partnership with lots of interest and lots of public support."

PAREI provided all project coordination and a local in-house crew to design the site, conduct site work

right: 121kW PV array at the Plymouth Village Water and Sewer District.

left: Key players in the group that contributed to the construction of the PVWSD solar array receiving a project incentive check from New Hampshire Electric Co-op. from left: Larry Mauchly of Mauchly Electric; PVWSD Supt. Jason Randall, Interim Admin. Merelise O'Connor, Commissioner Chris Woods; NHEC Program Admin. Scott C. McNeil; PAREI Dir. Sandra Jones & member Tim Gotwols; Kim Frase of Frase Electric. Photos courtesy of William Adams, Mauchly Electric.



and assist with the assembly of the ballasted solar racking. Frase Electric of Sandwich assisted with system design, installed the inverters and completed all of the AC wiring to the meter that records the Renewable Energy Certificates generated by the system. Larry Mauchly and his apprentice William Adams of Mauchly Electric of Plymouth provided installation, grounding and wiring of the solar photovoltaic modules. Staff from the PVWSD plant assisted with numerous tasks, including trenching, unloading deliveries, ballast block transportation, and preparing the maintenance garage for installation of five 20KW SolarEdge Inverters. The NH Electric Coop provided technical support, line design/tie-in and a \$20,000 incentive through their Commercial Solar PV Incentive Program.

PAREI also made sure to source services and supplies locally and nationally wherever possible.

The solar panels are American made from Solarworld in Oregon, and the ballasted racking system was made from Schletter in North Carolina. Among the New Hampshire businesses that supplied goods or services were Agway, Ashland Lumber, Café Monte Alto, Chase Street Market, Community Guaranty Savings Bank (financial services), Dekal Stickers, Latulippe Construction, Michie Corporation (made the concrete blocks), Needham Electric, Rand's Hardware and Provan & Lorber - Engineers & Planners.

The 440 panels in the new array give it a capacity of 121 kilowatts, and are expected to produce about a quarter of the needs of the PVWSD, or 145,000 kilowatt-hours per year.

The array's output can be viewed in real time by visiting <http://bit.ly/15FiwoK>.

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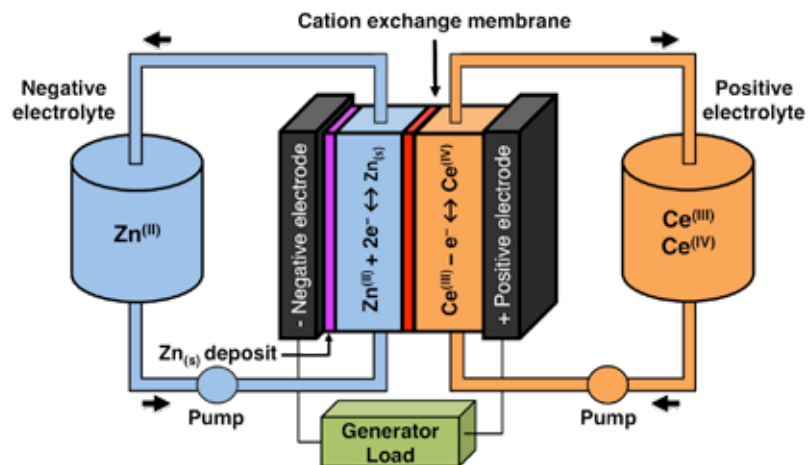


Diagram of a zinc-cerium redox flow battery. Created by Earth-Rare, posted to Wikimedia Commons.

cont'd from p.7

and are separated by an electrolyte of molten salt. The three liquids are not capable of mixing, and so remain stratified with the lightest, magnesium, at the top and the heaviest, antimony, at the bottom. As bizarre as this might sound, the design of the battery is otherwise rather ordinary. You can see more at [www.ambri.com](http://www.ambri.com).

These are just a few of the many battery designs that are being developed. They show some promise that in the near future, batteries with very different properties will come to market, and are likely to be much less expensive than most current batteries, with much longer lifetimes. And that will help us move to a distributed, entirely renewable, power system.

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# 181 New Solar Contracts Signed in the Upper Valley

## SOLARIZE UPPER VALLEY CLOSES ROUND TWO, OPENS ROUND THREE

By Allison E. Rogers Furbish

As of its January 31 deadline, the second round of the Solarize Upper Valley initiative saw 181 contracts signed for new solar photovoltaic (PV) projects – a total of more than 1,086,535 kilowatts of new solar power – across 10 towns in the Upper Valley.

All of the Solarize communities – Hanover, Orford, and Andover-New London-Wilmot, in New Hampshire, and Pomfret-Woodstock and Randolph-Brookfield-Braintree in Vermont – at least doubled the amount of solar PV in their towns, and most saw enough kilowatts contracted to reach the lowest pricing level for residents.

“We’re thrilled with the success of our second round of Solarize Upper Valley, and we applaud the hard-working community volunteers and installer partners whose efforts encouraged so many residents to go solar this year,” said Sarah Simonds, energy program manager at Vital Communities, the White River Junction-based nonprofit that coordinates the initiative. “And while 181 signed contracts, a total of more than 800 residents signed up for solar site visits. That’s a lot of people in the Upper Valley thinking and talking about solar.”

This round of Solarize Upper Valley launched last October with a host of public outreach efforts continuing through the January 31 deadline. The first round of the initiative, which ran from March through June 2014, resulted in

120 homeowners signing contracts to go solar in Cornish, Plainfield, and Lyme, New Hampshire, and Thetford and Strafford, Vermont.

Solarize Upper Valley is a program of Vital Communities aimed at making small-scale solar energy more accessible across the region. The program teams up local volunteers with solar PV installers for a 15-week community outreach campaign to help residents go solar by making it easy for homeowners to take the first step – requesting a free site visit. Through a tiered pricing structure, the cost goes down for everyone as more people sign contracts to go solar with the community’s partner installer. And the deadline serves as an incentive for people to act before the deal is gone.

### Get Involved in Round Three!

Vital Communities will coordinate a third round of the Solarize effort this year, with public launch events in June and a deadline of September 30. Upper Valley communities interested in learning more are encouraged to attend an information session on February 19 at 5:30 p.m. at the Montshire Museum of Science. Proposals from communities wishing to participate are due by March 16.

For more information about Solarize Upper Valley and how to get involved, visit [VitalCommunities.org/Solarize](http://VitalCommunities.org/Solarize).

Allison Furbish is communications director for Vital Communities.



Solarize Orford installer partner Chris Milner of Mil-house Enterprises completes a ground-mount installation in Orford in December.

### SOLARIZE UPPER VALLEY ROUND TWO RESULTS\*

#### HANOVER:

62 contracts, 357.125kW

#### ORFORD:

14 contracts, 81.76kW

#### ANDOVER-NEW LONDON-WILMOT:

38 contracts, 236.155kW

#### POMFRET-WOODSTOCK:

26 contracts, 171.595kW

#### RANDOLPH-BROOKFIELD-BRAINTREE:

41 contracts, 239.9kW

\*as of Jan. 31, 2015

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# Community Solar: the Game Changer for the Green Revolution

By Daniel Hoviss

Meriam Webster says a Game Changer is a newly introduced element or factor that changes an existing situation or activity in a significant way.

Right now community solar is seeing an explosion in adoption. Systems are being installed all across Vermont and other parts of the country.

There are many reasons why community solar is getting very popular and receiving grant awards.

Not everyone has that perfect roof or sunny back yard to put a solar panel on. So community solar makes it possible for a much higher number of people to "go solar."

Doesn't affect aesthetics. A homeowner doesn't have to worry about how solar panels would look on his or her roof or about the need to take down any shade trees.

Installing your own solar electric system will mean that you as the homeowner or business owner will have to assume the burden of insurance and maintenance for that system for 30 years, while most manufacturers warrant the products for less time. Community solar often includes insurance and maintenance agreements.

Community solar offers potentially more reliable electric production, as compared with typical power from the "grid," because it is done in an ideal location. If power goes out to your town or street, your community solar installation may still be producing power and feeding that to the grid. Using higher voltage commercial grade equipment in an ideal setting also results in greater efficiency.

Many community solar installations are seasonably adjustable, so they generate more electricity during the year than roof mounted or non adjustable ground mounts.



This 150kW Community Solar project in Brattleboro, Vermont, has been providing power to six residences and three businesses since October 14th, 2014. Photo courtesy Soveren Solar.

You can move to a new home or office and your electricity credits follow you, as long as you stay in the territory of the power company with which you made your community solar deal.

You can give, donate or transfer (in a one-time sale) your electric credits anytime, to anyone who is a customer in the power company's territory.

You do not need to own your home or office to invest in clean energy.

Greater access. This means anyone who rents or owns and pays a power bill can benefit from community solar, as long as he or she is within the power company's territory, they can join the community solar group. This can include whole states, or large portions of a state or just communities, as determined by the developers.

## Types of community solar

**Type 1:** Investors pool their money to create a company or work with existing companies, to finance the project. Contractors build the system and investors sell shares. This has the advantage of a set price per watt, and no need for tax incentives. It works well for fixed income or people that are no longer paying income tax.

The downside is that this tends to be slightly more expensive; as the end user cannot own the panels for five years while investors make use of incentives and depreciation. Sizes up to 500kw. Sun Farm VT and many others use this approach.

**Type 2:** Company or group builds system (locally funded by owners); member-owners own panels and possibly infrastructure from day one. This is often less expensive as members can take advantage of the federal and (for businesses) federal and state tax incentives and the accelerated depreciation. Sized up to 150kw per project Soveren Solar

and Solar Electric Collective and others use this approach.

**Type 3:** Company builds system, sells power to 'off takers' like towns or schools or in some cases multiple homes and businesses. There is no upfront cost. This is just a power purchase agreement and may have an option for buyout after 10 years. Sun Common uses this approach. It is not exactly community solar but may be bundled in a project that incorporates community solar as part of the financial structure.

**Type 4:** Other types of solar projects are possible – District Community Solar, for example. There is excitement over 'solar on landfills' and the district that owns the landfill would sell excess power in a power purchase agreement to towns, or invite towns to purchase a portion of the system or panels to offset the investment costs of the project, to ensure long term reliable clean power for municipalities that are part of the waste district.

School districts across the nation are also now taking a serious look at this model, as the school districts would own all (or portion of) the panels in a large project, and power would be credited to the schools as a line item, offsetting consumption. Since schools are funded by taxpayers, and since there are tax incentives not available to non-profits, school districts must partner with for-profit entities that can make use of those incentives.

In short, there are many exciting projects and companies offering community solar in Vermont and surrounding states.

Daniel Hoviss writes for GET, works at e-Solutions.org and sells community solar for Soveren solar; Soveren has produced seven Community Solar installations to date and is working on several more this spring.

## IT'S OFFICIAL! -- G.E.T. IS A Vermont Green Business

State Designates Green Energy Times as a Vermont Green Business

Bradford, VT., January 13 – Green Energy Times, located in Bradford, VT, has been named a Vermont Green Business by the State of Vermont, for environmental stewardship and sustainability efforts. The Vermont Green Business Program provides assistance to businesses desiring to "green up" their operations and recognizes businesses of all sizes for meeting a set of environmental standards. These standards are posted on the program websites (www.vbep.org).

In addition to participating in an environmental assessment, Green Energy Times (GET) adheres to green and environmentally-conscious practices wherever possible in all aspects of operation. Additionally, GET engages those who understand the importance of this for any assistance they can offer, to improve environmental impacts. Green Energy Times is focused on creating environmental understanding through education and examples in our bi-monthly free, mission-based publication.

We are 100% powered by renewable energy and consider our carbon footprint in everything we do.

The Vermont Green Business Program is a joint effort between the Department of Environmental Conservation and the Vermont Small Business Development Center and is voluntary and free of cost to participating businesses. Vermont businesses designated as Green Businesses are recognized for going beyond compliance with existing environmental regulations, using resource conservation strategies and implementation of environmental best-management practices.

### About Green Energy Times:

"Our mission is to motivate everyone, including businesses, communities, organizations, and individuals, to be able to make educated measures to reduce their carbon footprints and to be responsible for our sustainability and energy independence. We believe the need to accomplish these things is urgent, both to stop climate change and to provide for the health and well-being of both the environment and all people. Furthermore, we are convinced that while education is one element of accomplishing these ends, another is by being living examples for others to follow."



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# Growing a Community Solar Farm

GREEN MTN. COMMUNITY SOLAR IN GROTON, VT



Local high school and college students who helped build the project are, left to right, Natalie Page, Rowan Johnston-McWilliams, Zac Bergh, Tiernan Johnston-McWilliams, Hector Soveren, Jake LaVaude, Caleb Genereaux and Eli LaVaude. Photo courtesy of Bruce Genereaux.

Thirteen Vermont families, Wells River Savings Bank and Catamount Film and Arts have collaborated with Green Mountain Community Solar (GMCS) on an off-site community solar array in Groton, Vermont. The 140-kW Groton Community Solar Farm was completed and put online in December, generating power and producing net-metering credits. Electric generating from the farm reduces the electric bills of its subscribers in proportion to their investment, and produces credits instead. The solar farm is located in Green Mountain Power service territory, through which it is net-metered.

Construction was completed over a period of eleven days in December. Vermont contractors, local high school and college students, and other local residents all teamed up with lead installation contractor, Soveren Solar of Putney, Vermont.

The project uses 654 Canadian Solar 260-watt (DC) panels. Fixed mounts hold the panels tipped at a 22° angle to harvest the sun's power. Seven 20-kW Sunny Tripower 20000 TL-US inverters convert the DC electricity from the panels to AC as required for connection to the grid.

Panels were sold to subscribers for approximately \$1,100 each and are expected to yield customers about \$60 per year each in savings for 25 years. With federal investment tax credits, the payback period is about 12 years. Project completion in 2014 meant subscribers could claim tax credits for 2014.

Participation of Wells River Savings Bank and Catamount Film and Arts meant GMCS was able to meet initial goals. This was a great help in ensuring the project's overall success.

Wells River Savings Bank is a commercial subscriber. Bank vice president Graham Gove commented, "The bank is pleased to join this community effort and to have a portion of its electricity generated locally and from renewable sources. Additionally, we find this a good investment for the bank."

Jody Fried, the executive director of Catamount Film and Arts, added his own comment, saying, "This project, following our renovations and energy audit savings,

allows Catamount Arts to control its costs and participate in sound environmental practices right here in the Northeast Kingdom."

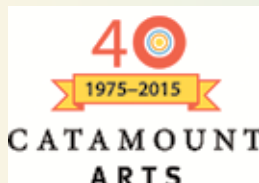
A community solar farm provides those who cannot have solar panels on their roofs or in their yards with a way to have them elsewhere. Jim Wuertele, the town of St. Johnsbury's energy committee coordinator said, "Here is the perfect solution for those wanting to go solar but can't do it at their house." There are subscribers in Weybridge, Norwich, Wilder, Pittsfield, Barnet, Newbury, St. Johnsbury, and Ryegate.

It is important to recognize that while maintaining the quality of the environment means eliminating pollutants, noise, and other physical stresses is vital, it is also important to our well-being that the environment be kept as visually attractive as possible. GMCS works to minimize visual impacts of solar farms by coordinating with towns, Vermont's Agency of Natural Resources and other partners.

Subscribers could arrange financing through their own banks. Since not all banks are prepared to finance solar panels, GMCS has established working relationships with area banks and credit unions to help customers get financing for their panel purchases. In this case, they were working through Green Mountain Credit Union and Vermont State Employees Credit Union. This is part of an overriding commitment to bring the financial and environmental benefits of solar power to the businesses, non-profit organizations, and people of Vermont, even if they have no place of their own to site the panels.

The GMCS website is GMCommunitySolar.com, and the number is 802-526-1191.

Many thanks to our Sponsor



## COMMUNITIES ARE GOING SOLAR

### GOODBYE VERMONT YANKEE

cont'd from p.1

expensive backup systems for base-load plants. The real question should not be whether we will always have power if we depend on renewable sources, but how much backing them up will cost. It turns out that backup power for distributed renewable systems is far less expensive than backup for base-load plants.

Base-load power plants are inflexible in their output and have to generate power when no one wants it, selling power at a loss or even at negative prices. By contrast, wind turbines can be shut down easily, and solar plants produce power at the time demand is highest.

Wind and solar power prices have dropped to that point that our least expensive power source is wind, and solar is tied with gas for second place. Projections are that the prices of wind and solar will continue to decline, and those of gas, coal, and nuclear will keep going up.

Solar and wind power both have the advantage of costs that approach zero

once the initial investment is paid down. This makes it easy to project costs over a period of decades. This is not true of base-load plants whose fuel sources are subject to changes in supply.

Local communities can use distributed renewable power to form micro-grids that may continue to produce power in storms and other times of emergency.

Distributed renewable power sources can be locally owned, keeping the profits in the local economy, benefiting local businesses and households. They can provide more jobs than base-load plants and reduce taxes.

Renewable power generation does not produce waste. Even accounting for greenhouse gas emissions from construction, they are our cleanest power sources.

Distributed power sources require less investment for building and maintaining expensive power grids.

Whether we like nuclear power or not, VY has shut down at last, and we can say "Goodbye." But as we see the advantages of renewable sources, we can add, "Thanks, but we don't need you anymore."



# Microgrids Are Coming!

By George Harvey

The Brattleboro, Vermont Energy Committee recently formed an Integrated Energy Systems subcommittee with the purpose of investigating such solutions as microgrids and the technologies that might be used with them. A microgrid is a system that has its own generating and storage capacity, with a potential to operate independently of the grid, if necessary. It might be a single building, a neighborhood, or an entire community.

Kirk Shields, Director of Business Development (Energy Innovation) at Green Mountain Power (GMP), came down from Rutland to share the utility's ideas with the committee. Perhaps the most striking thing about the presentation was learning that Green Mountain Power was still in the rather early stages of developing a new business plan that will include establishing new relationships with communities and community solutions. We might hope this means we have the opportunity to

GMP can sell, and they are not worried as they move into a new business paradigm. In fact, he said, that is what they are currently researching for their future.

There clearly is a lot to learn. For example, he told us about storing thermal energy of a type we had never known about. GMP has actually installed a system in one building that uses electric power at night, when rates are low, to heat a thermal mass that in turn has its heat transferred to the building through the day. "This can help balance the grid," he said. "If we can do that, we can profit from the increased stability."

GMP seems interested in being part of community, business, and organizational solutions, without much prejudice about what they may be. "Our engineers will tell us if they think an idea is impractical or impossible," Shields explained. That said, they are pretty much open to any ideas that make sense for all parties.

Shields mentioned four important points about such systems:

It is important to consider how the customer is impacted. Any noticeable change in service should be an improvement. In fact, a microgrid in Rutland allows the customer to be an active or passive participant, or not to participate and have no noticeable change in service.

Costs have to be taken into account. When we transition to renewable, distributed power, we should expect to save money in the process. That is the experience in most places.

Reliability is an important issue. Microgrids operating in a distributed system should be considerably more reliable than the grid to which it is attached. This is because the microgrid should have both generating capacity and storage. This is one of the attractions of the community microgrid.

It is clear that the legacy business model, the model nearly all utilities use today, is not sustainable. This means it is imperative that new ones be developed. GMP has taken a lead in developing those models.

We are clearly only at the beginning of the process of establishing a new paradigm and it is exciting to have the opportunity to participate and contribute.



Solar canopies on the Hopkins parking garage at UC San Diego supply the campus microgrid. The campus generates 92% of its power.

provide input for that plan.

GMP has been working with communities to develop new solutions. The most noted example is Rutland, which GMP is turning into the "Solar Capitol of the Northeast." Solar arrays have been installed under different ownership schemes, clearly with some view to finding what people's preferences are and what options work well. Additionally, individual homes have been given deep energy retrofits, including insulation, sealing, more efficient appliances, heat pumps, and solar panels.

We wondered aloud how a utility can make a living by helping people use less of what they are selling. Shields told us that there are many services and products

## Affordable POWER *cont'd from p. 1*



Inside the Steels Pond powerhouse. Water comes through the supply manifold on the left to feed up to five turbine/generating units. The smallest generating unit is the dark green cylinder on the right.

is just as relevant today as it was when it was written. The hundreds of dams are mostly in good shape, ready for refurbishment with new generating equipment.

Currently, Lori is developing affordable equipment. What is innovative is that this equipment can arrive on the back of a truck, and be installed, with only minor civil works, hardly a shovel in the ground. There are over 75,000 unpowered dams in the country. Community Hydro hopes that with affordable equipment, and a change in permitting, to power 10,000 of the 75,000 unpowered dams in the country. Most of these dams are here to stay because they provide water supply, recreation, fish and wildlife habitat, flood control etc. The installation of affordable hydro-power at these sites can help en-

sure that these resources are maintained.

Indeed, on January 21, the US Department of Energy announced it would provide incentives for establishing power generating at existing dams, at 2.3¢ per kWh. Their estimate of the total nationwide output of the hydro facilities that could come online under the program is 12,000,000 kW. This is the output of about twelve nuclear power plants, and the dams can run nonstop. The amounts of power we are considering here are far from trivial.

The question of small hydro-power is becoming more clearly important to lawmakers of both political parties. When the US Congress took up a law on what is called a Federal Energy Regulatory Commission "conduit exemption," which provides for very much simplified permitting for getting power from water going through existing conduits (irrigation, municipal water supply, etc.) the result was bipartisan legislation of a type not often seen today. The bill passed unanimously. This is a great precedent, and we hope it is a small step to get similar legislation to simplify permitting to power or re-power existing dams.

One thing that we might predict about hydro-power of all sorts is that we will have more about it in future editions of Green Energy Times.

### Do you get your power from PSNH?

- Are you a large (> 250,000 kwh/yr) electric user?
- Are you interested in a long-term contract paying less than the PSNH rate? (currently 10.56 cents/kwh)
- Do you want to use green power? generated in NH?



Our hydro is looking for members for a group net metering contract to start in April, 2015. The contract would be mutually beneficial, as the PSNH customer would pay less than retail — and we would receive more than wholesale.

**Schools, municipalities, non-profits, and businesses preferred.**

If YES, contact us ASAP:  
sphydro1@gmail.com



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## 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>
- \$.40/kWh/year/Day up to \$3000 for ShW.
- commercial/industrial = \$1.50/100Btu/day up to 1100kWh/day for ShW
- special customer\* = \$1.00/Watt up to 10kW. \$.80/kWh/year up to \$45,000 for ShW. \*\*Group net-metered projects are only eligible for residential customers with residential meters.
- ShW Efficiency Adder - adder is calculated separately and added to standard incentive subject to customer caps (eligibility requirements apply, contact RERC)
- residential = \$.40/kWh/yr equivalent for SHW. Capped at a cumulative \$350, residential customers; \$450, commercial/industrial/special customer = \$.15/W; \$.050/100Btu/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 \$8750.

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

## Pellet Heating

- advanced pellet heating systems -- up to \$2500 per boiler (+\$350 if an audit is completed).Details at [www.RERC-vt.org](http://www.RERC-vt.org)
- 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 heat and 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
- limited time \$500 bonus for projects completed by 12/15/2014

## 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 = \$.80/Watt D/C up to \$50,000
- Solar thermal = \$.07(or\$.12 for systems of 15 collectors or fewer) per thousand- Btu per year, up to \$50,000

Contact [Elizabeth.Nixon@puc.nh.gov](mailto:Elizabeth.Nixon@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

- \$.075/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 Solar Thermal (Hot Water)

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

## Commercial Solar PV

- \$.050 per watt up to the lesser of 15% of installed cost or \$20,000

## Commercial Fossil Fuel Program

- Incentives of 35% up to \$15,000

## 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

## WWW.NHEC.COM

## NH HOME PERFORMANCE

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.



## 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/ret-rofit.html](http://www.nhsaves.com/residential/ret-rofit.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. 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 EFI.

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

## 2014 ENERGY STAR® RESIDENTIAL HEATING, COOLING, & WATER HEATING EQUIPMENT REBATE

Rebates of up to \$1,500 on high efficiency Furnaces and Boilers, \$200-\$500 rebates on Mini Split Heat Pumps, up to \$800 rebates on water heaters, rebates on programmable and Wi-Fi thermostats

Program details and application at [www.NHSaves.com/heatingcooling](http://www.NHSaves.com/heatingcooling)

## 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.

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), WMECO or a participating Municipal Light Plant community. **Ends Dec. 2014.**

Residential Rebate: \$75/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 = \$3860 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 = \$2100 Visit <http://www.masscec.com/programs/commonwealth-solar-hot-water>

**There will be a new residential loan program for solar PV to be announced in November, 2014.**

## MASSSAVE HEAT LOAN SHW

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

## Efficiency

After conducting a free residential Energy Audit, residential customers are eligible for up to \$25,000, commercial loan up to \$100k at 0% interest heat loan with terms up to 7 years to cover the following energy efficiency improvements: atticwall-base-ment insulation, high efficiency heating systems, high efficiency domestic hot water systems, solar hot water systems, 7-day digital programmable thermostats, Energy Star replacement windows

Available only to utility customers of 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.

## MASSACHUSETTS SOLAR LOAN PROGRAM

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

The \$30 million program, a partnership between the Massachusetts Department of Energy Resources (DOER) and MassCEC, will work with local banks and credit unions to provide financing to homeowners interested in solar electricity. DOER's program design will work with banks and credit unions to expand borrowing options through lower interest rate loans and encourage loans for homeowners with lower income or lower credit scores.

Since 2008, the solar electric industry in Massachusetts has grown into a robust economic sector with over 1,400 businesses and 12,000 workers, with enough solar electricity installed in the Commonwealth to power more than 100,000 homes.

Mass Solar Loan will continue to grow this sector, while allowing more homeowners the ability to achieve the cost savings and environmental benefits of this clean, renewable energy source.

[www.masscec.com/programs/mass-solar-loan](http://www.masscec.com/programs/mass-solar-loan)

## DEPARTMENT 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 Data Acquisition System monitoring must be utilized for PV systems >10kW 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 residential solar hw or pv systems.

There is no increase in property tax assessment for residential hw or pv systems for 20 yrs.

## NEW MASSACHUSETTS SREC POLICY

Massachusetts' new version of its Solar Renewable Energy Credits Program is informally being called SREC II.

Under the earlier version, which expired last year, credits were given regardless of where the solar system was installed. SREC II prioritizes sites, however, by using an SREC factor based on the type of installation. The credits provided for energy produced by a system are calculated by multiplying the factor times a full credit value.

Full credit is given for residential, parking canopy, emergency power, or community-based systems, or any other system of less than 25 kW. Larger systems get a factor of 0.9, if they are building-mounted or at least 67% of the power produced is used at the site. If a larger system meets neither of these criteria, but is built on a landfill or brownfield site, or if it is less than 650 kW, then it gets a factor of 0.8. Systems that qualify for none of the foregoing get a factor of 0.7.

**More information can be found at:** [http://bit.ly/Mass\\_SREC\\_II](http://bit.ly/Mass_SREC_II)

## VT'S ENERGY EFFICIENCY PROGRAMS LEAD NATION

The Vermont Public Service Department has compared Vermont's electric energy efficiency program with programs in eight other states. The evaluation shows that at similar costs, Vermont's electric energy efficiency programs save more energy.

"I am gratified but not surprised that Vermont's Energy Efficiency Utilities show greater benefits for dollars spent than systems in other states" said Chris Recchia, Commissioner of Vermont Public Service Department. "Vermont is a national leader in energy efficiency and this report highlights the success of our programs."

The Department's benchmarking analysis compares reported costs and savings for program years 2011 and 2012. The analysis includes results for energy savings as well as for peak demand; Peak demand savings reduce the need to build new electric generators or power lines.

"Benchmarking is an appropriate tool to ensure Vermont's programs compare well to programs in other jurisdictions. We are pleased to see Vermont's Energy Efficiency Utilities perform so well compared to their peers" said Asa Hopkins, Director of Energy Policy and Planning in the Department.

Electric energy efficiency services are provided in Burlington by Burlington Electric Department (BED) and by the Vermont Energy Investment Corporation to the rest of the state as Efficiency Vermont (EVT). Both providers are referred to as Energy Efficiency Utilities (EEUs). The evaluation compared performance for both EVT and BED to that of twenty-seven other energy efficiency service providers in eight jurisdictions (Maine, Massachusetts, New Hampshire, Connecticut, Rhode Island, New York, Maryland and Minnesota).

Conclusions include the following highlights:

- EVT's and BED's energy efficiency programs produced higher savings compared to most of the other organizations benchmarked. EVT's programs saved about 2.4% of utility electric sales per year, while BED's programs saved about 1.9%. The median savings for the benchmarked organizations is 1.7%.
- EVT's first-year cost of saved energy is slightly less than the median for the organizations benchmarked in this analysis, while BED's is just above the median.
- EVT's and BED's energy efficiency programs have the second- and third-highest peak demand savings compared to the rest of the benchmarked organizations. EVT's and BED's programs each saved about 1.3% of retail peak demand per year, while the median savings for the group of compared organizations is less 1.0% of retail peak demand.
- EVT's cost of peak demand savings is less than the median for the organizations benchmarked while BED's cost of peak demand savings is above the median.

Every three years the Department assesses the EEUs' performance relative to similar efficiency efforts in other jurisdictions. Benchmarking is also considered in the overall performance assessment conducted by the Vermont Public Service Board every six years. This is a review process that considers the effectiveness of Vermont's EEUs and determines whether it is in the best interest of Vermont ratepayers to solicit competitive bids for delivery of efficiency services, or to re-appoint the incumbent providers.

A copy of the full Benchmarking report is available at: [bit.ly/VT\\_PSB\\_benchmark](http://bit.ly/VT_PSB_benchmark)



# The High Mowing School in Wilton, NH IS NOW HEATED WITH BIOMASS!



By Jim VanValkenburg, Froling Energy

High Mowing School had a strong desire to eliminate its use of fossil fuels by switching to a local green fuel. However their dream of installing biomass boilers would take a big investment with lots of ongoing maintenance. Then Xylogon, a Keene-based company, gave them an exciting "turn-key" proposal. Opportunity was knocking!

The solution was fairly simple: The school agreed to a 20-year service agreement for a set annual fee where Xylogon promised to provide, install and maintain a central biomass boiler system that would heat all nine of the core campus buildings. Even though Xylogon provides all fuel needed on campus for the duration, the agreement encourages conservation. Should the campus or Xylogon find ways to cut back on their use of heat, their annual fee is also reduced. That made sense to everyone.

Most of the school's many oil boilers were of less-than-average efficiency and nearing the end of their useful lives. It was calculated that nearly \$250,000 would

need to be spent in order to bring all of these boilers up to date. So it was a good time for the school administration to act on an arrangement where all capital expenses for heating equipment would be financed by Xylogon.

Froling Energy was contracted by Xylogon to build a central boiler house and the new district heating system. This included constructing the fuel silos, installing underground pipes to each building, removing old oil boilers and installing heat exchangers in each building.

Two Froling TX-150 fully automatic biomass boilers (one million BTU total output) were installed with a 3000-gallon insulated buffer tank. They are able to burn either wood pellets precision dry wood chips. PDCs are a new alternative fuel, wood chips with no bark, that are about the size of a common match book, and with a moisture content of 30% or less. Two HTP ModCon condensing propane boilers were also installed (1.7 million BTU total output) to provide dual-fuel redundancy. High ef-

iciency pumps were installed to circulate hot water from the boiler house to the entire campus. The main goal is to provide 180-degree water to every building in the district, mainly from the biomass boilers. The propane boilers will turn on at times of very high demand.

PDCs, the new main fuel on campus, are manufactured at Froling Energy's production facility in Peterborough. High quality hardwood chips from a number of local sources are screened, then re-chipped down to be no bigger than matchbook size and dried to 25% moisture. Two deliveries a week are brought to the school during the coldest part of winter.

All of the main buildings on campus are completely reliant on the new central boiler system for heat and hot water so Froling Energy Service crews are diligent about maintaining the system to make sure everything is working well. A control and

monitoring system, Boiler Maestro by DCM Logic, monitors boiler operations, alerts them to problems and precisely calculates the heat output of the biomass boilers, which enables HMS to qualify for receiving New Hampshire Thermal Renewable Energy Credits.

Impressive Results: The High Mowing School campus is now no longer burning 31,000 gallons of oil. With the new system they expect to burn 500 tons of PDCs and 4,000 gallons of propane. So they will have reduced fossil fuel use by over 90%—equal to cutting 28,000 gallons of oil! This is a carbon dioxide reduction of over 330 tons per average year—and a very good example for the students at HMS.



## BURN PELLETS WITHOUT ELECTRICITY

By Pablo Fleischmann, owner of GEO

The Wiseway gravity-feed pellet stove is a wonderful new invention which burns pellets without requiring electricity. Many people who have been shied away from a conventional pellet stove's dependency on electricity are finding these to be great alternatives. The stove will put out 55,000 BTUS on high which is comparable to that of a medium-sized wood stove. They are simple to operate and lightweight enough to be semi-portable, making them ideal for camps, cottages, or workshops.

Gary Wisener, the inventor, made the first one in 1999 in Medford, Oregon for his own personal use, from his experience as a machine shop foreman. He would bring it up to his hunting cabin, use it on his porch, and heat his home with it. Word spread and soon he was building them for neighbors, friends, and family. Now he has a fledgling distributor network across the US. Green Energy Options (GEO) in Keene, NH has sold more than a dozen stoves to customers for various uses. One heats a home from the basement, one heats a yurt, and another a greenhouse. "Because of its unusual shape, it's one of the first things people comment on when they come to our store," says manager, Owen Travers. "Many of our customers are concerned with energy consumption or have outbuildings with no utilities, so it's a natural fit."

"The one thing we stress when we have customers considering the stoves is ensuring the proper draft." Since the stove has no fan or auger, the natural draft is essential for the stove's functioning. Too little draft and the stove will back-puff into the house. Too much draft and the stove cannot be burned on low. "We use a 4" pellet vent pipe, barometric dampers, Vaccu-StacksTM,



The Wiseway gravity-feed pellet stove

and fresh air kits to fine-tune the draft. Each application is slightly different. The stove works best when vented straight up. Ninety-degree bends can't be used and horizontal runs must be minimized." For 2014/15, Wiseway has released a new version of their stove that produces more heat and requires a conventional 6" stove pipe and chimney. A new feature is also a window to view the flame!

"I think we are seeing the tip of the iceberg with these first gravity-feed stoves. There is a lot of room for experimentation and diversity with a stove like this." Ice-storms, watch out! Your days of disabling heating devices may be numbered!

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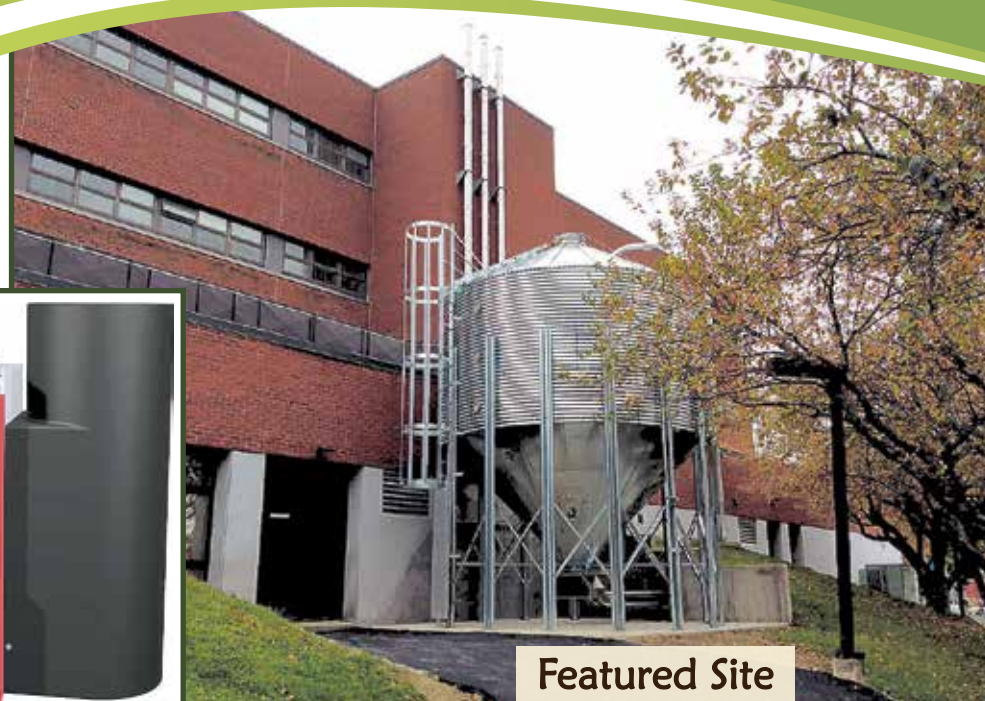
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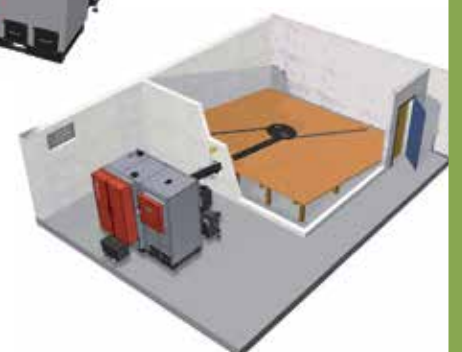
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# SUSTAINABLE SUGARING

## LOOK OUT FOR VERMONT SYP SUCKERS!

By N. R. Mallery

For those of us that tap our trees in late winter to early spring, the sweet taste of that first flowing sap is a long awaited treat. If you have ever sipped or sucked on the fresh sap directly from the tree, you will agree that this opportunity is worth waiting for.

When sugaring season is over, you can still enjoy the subtle sweetness of the fresh taste of maple sap, thanks to Bob and Rich Münch of Poultney, Vermont. When the brothers were sipping maple sap while doing some backyard maple syrup making, they came up with a great idea. With a little carbonation, a terrific beverage, that only maple sap tapped right from the maple tree could provide, could be bottled and enjoyed all year long!

A few years ago, while staying at a B&B here in Vermont, I had my first taste of this subtly sweet and natural refreshment -- which made a lasting impression. Not knowing the name of the maker, I was left to only a fond memory until the first trees are tapped each sugaring season. But, this past fall, I was lured to a bottle in a local business that specializes in Vermont-made products. The label said, Vermont Maple Juice, a Maple Seltzer. My curiosity was piqued. Reading further, it said "No preservatives, no artificial color or flavor, no sugar, no sodium," and that it was made locally. What persuaded me that I had to try this unusual product was the story on the label: "An all-natural product that starts when winter draws to an end and the days become warm and sunny," and continues, "The mountain snows are naturally filtered through the roots of the sugar maple. The roots send forth their stored nutrients up into the crown of the tree where small amounts are tapped-off to create this refreshing light sparkling drink with a hint of maple sweetness." The "sugarer" in me drooled forth and I am now hooked.

Although it is available at the food buying club I belong to, I do see it at many other local outlets, or you can order it from their website. In fact, at Thanksgiving time, my daughter-in-law from California could not get enough of it. Guess what she got for Christmas -- a case of Maple Seltzer.

So - as you are enjoying the wonderful taste of this year's maple harvest, remember that you can enjoy it all year long. It's more than a novelty, it's refreshingly yummy.



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**MAPLE WINE**  
*... only in Vermont!*  
Photos courtesy of Fresh Tracks Farm Vineyard & Winery

By N. R. Mallery

When you live in Vermont, the taste of pure maple syrup might just be in your blood.

Well, here's a sustainable story about the maple wine worth taking note of.

This fall, while traveling south on Montpelier, on Route 12, my attention was drawn to a solar system in a natural setting for a winery called Fresh Tracks Farm and Winery -- and it was open!

Call it fate, but what I learned and tasted is why I am sharing this story. The inviting, warm atmosphere led me to a taste-testing like no other that I had ever experienced. On the menu was Maple Wine! All I could say upon that first taste crossing my tongue was WOW! The couple next to me had the same reaction. What an incredible find -- like a rare gem.

In 2002, Christina Castegren had a sustainable vision for the whole farm that started as a labor of love. She knew that Vermont presented a challenge to grow grapes for wine production, let alone to do it sustainably.

Sustainable practices are at the heart of everything they do at Fresh Tracks Farm. They believe that what they do and how they live on and around their land has a direct impact on what they receive from it. Geothermal is used as a renewable energy source to heat and cool the Tasting Room and Winery. Solar from an 8.1 kW system supports a portion of their electricity, as well.

A variety of natural farming principles are drawn upon to work the land with knowledge of both science and tradition to foster healthy growth and responsible usage. Tracy Roux, the Tasting Room Manager, commented, "sustainability is also about running an honest business, providing good value and quality products to our customers, and a fair living for their employees. We believe that everyone should benefit from being a part of Fresh Tracks Farm."

Farming at Fresh Tracks has included some maple syrup production, since the start. The sugaring set-up includes a vacuum system and a wood-fired pan, where they produce about twenty gallons of syrup each year. Twenty gallons are for syrup for retail, plus maple sap used for wine production. They concentrate the sap to a sugar content suitable for fermentation. Maple fermentation is difficult and takes longer than for grapes. It is necessary to make the maple wine in small batches - and can take up to four months. Maple wine is a dessert wine, which means that it is sweeter, higher in alcohol, and the perfect post-dinner treat.

All I can say is that tasting is believing, and that you can likely find this gem only in Vermont!

More info about Fresh Tracks Farm and Winery is at [www.freshtracksfarm.com/](http://www.freshtracksfarm.com/)



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## NADAV MALIN'S TOP THREE REASONS ...to Get Yourself to BuildingEnergy '15



"NESEA as an organization and the annual BuildingEnergy conference in particular have been touchstones throughout my 24-year career at BuildingGreen. I'm already getting excited about the upcoming BuildingEnergy conference in Boston, March 3 to 5, 2015."

Info and registration are online at [nesea.org/be15](http://nesea.org/be15)

### Here are my top three reasons:

**1.** New partnerships between NESEA and other organizations are bringing an influx of new speakers, energy, and content. In particular, there's the Net Zero Energy Coalition which had, until now, been centered mostly in Canada and California. Building Energy marks that group's debut in the eastern U.S., and their "conference-within-a-conference" brings a bunch of great speakers and some wacky west-coast idealism to our Yankee scene.

Also present will be a couple of representatives from the International Living Future Institute, which has its roots in Ecotopia (that's Oregon, Washington, and British Columbia) and brings us the visionary Living Building Challenge certification program. Living Building Challenge is really a manifesto in the guise of a rating system—and it's provoking some great conversations within the NESEA community and around the world, including places as far away as Australia and New Zealand.

**2.** NESEA's home-grown all-star cast will be out in full force. If you've been to Building Energy before you've already seen one or more of these great speakers, but they're always full of new perspectives and new ways of explaining the stuff you thought you understood the last time. Yes, I'm talking about you: Marc Rosenbaum, Chris Benedict, Andy Shapiro, Paul Eldrenkamp, John Abrams, John Straube, Terry Brennan, Alex Wilson. It's hard to go wrong when you catch any of these characters live and in-person.

**3.** Water. At my company, BuildingGreen, we (and lots of others in the green building world) have been clamoring for years about how water is a more critical global resource than energy, and such an important opportunity in the built environment. But we have yet, in my opinion, to come up with a meaningful framework with which to capture this opportunity.

I think that part of the problem is that we've been approaching the water challenge as if it's just a variant of the energy challenge, and trying to apply the same frameworks. Water is like energy in some ways: it's treated and distributed through a major infrastructure network, and we pay for it as a "utility."

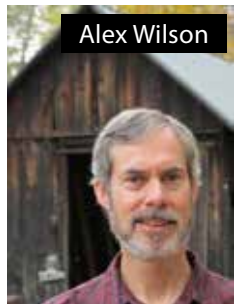
But water is also quite different from energy in important ways, and we have to think about it differently. For one thing, we don't actually use up water: we just contaminate it, or heat it up, or convert it to vapor and then release back into the planetary water cycle. That's why we have infrastructure not only for distribut-

ing potable water, but also for collecting and treating so-called "wastewater." We also have options for treating and reusing water on site, which we can't do with energy. And, finally, water is inherently linked to nutrients and our food cycle, and by rethinking those relationships we can transform how we use water in buildings and how we grow food.

All of these issues will be explored and shared by a collection of dynamic speakers in BuildingEnergy's two-part water series: Rethinking the Water Grid. I hope you'll come to those sessions and help frame the conversation so we can get a handle on the challenges and opportunities for water in the built environment.

Those are my top three, but there are many other reasons you won't want to miss BuildingEnergy '15. There is the impressive line-up of half- and full-day workshops, for example. If you're having trouble deciding which one to pick, you can't go wrong with my colleague Peter Yost's "Managing Moisture to Achieve Long Life and Low Maintenance." As the National Association of Home Builders 2014 "Green Building Educator of the Year," Peter makes learning fun better than anyone else I know.

But we have a deep bench at BuildingGreen—in addition to the aforementioned all-stars Peter Yost and Alex Wilson, you're sure to have fun and come away wiser if you get to "Lies, Damned Lies and Green Building Standards" by Tristan Roberts and Paula Melton. See you in Boston!



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# WEATHERIZATION IN NEW HAMPSHIRE EASY AND AFFORDABLE

Melissa Elander, J. Myers Builders, Inc.

At this time of year we New Englanders take stock of our winter preparations. Like the squirrel who has cached nuts for months in preparation, we check the carefully stacked rows of firewood, order pellets, and check oil and propane levels. Insulating and sealing air leaks in the home can help our home heating fuels go further.

New Hampshire homeowners may qualify for a 50% incentive, up to \$4,000, to help pay for energy efficiency improvements including lighting upgrades, water conservation measures, air sealing, and insulation through the Home Performance with Energy Star program. Homeowners can find out more about the Home Performance with Energy Star program by going to [www.nhsaves/save-home/](http://www.nhsaves/save-home/), or by contacting their utility company.

J. Myers Builders, Inc., an insulating company in Lisbon, NH, has been a contractor for the Home Performance with Energy Star program since 2009. Working with the utility companies, they help reduce energy use with audits, improvements, and rebates.

One person who benefited is Debra, of Milan, NH. She enrolled her home in the Home Performance with Energy Star program through Public Service of New Hampshire. The home is heated with an oil boiler, a pellet stove, and a propane fireplace. The home is a single level ranch with a heated basement, and a family



Energy Efficiency improvements will save this homeowner \$754.87 annually. The costs involved were reduced by over \$3,500 from rebates that are available.

room that is built on piers. It was the coldest room in the house.

The floor of the family room was insulated with fiberglass installed below two inches of rigid foam board. The rigid foam board was not sealed to provide a complete air barrier. J. Myers Builders, Inc. air-sealed at the perimeter of the floor system and all seams in the rigid foam board using spray foam. In the heated basement, the rim joists and above-ground concrete foundation were insulated with three inches of closed-cell spray foam.

The existing attic insulation was a mixture of cellulose and fiberglass, and was less than the recommended insulation value of R49. The attic was air-sealed and additional cellulose insulation was added to bring the attic to above R49. Air sealing an attic prior to adding insulation is important to stop heat loss from around lighting fixtures, wiring, fans, plumbing vents, chimneys, and any other penetrations.

Ventilation is a very important component of an energy efficient home, in order to control moisture and provide air exchange within the building. During the energy audit the existing bathroom fan was found to have a low exhaust rate. The weatherization project included the installation of a high exhaust rate bathroom fan to more effectively remove moisture from the home.

The original blower door test measured 2,507 cubic feet per minute (CFM at 50 pascals pressure) of air flow. After air sealing and insulation improvements were completed, the final blower door

measured 1,463 CFM, which represents a substantial reduction in the heat loss in this home.

The total project cost was \$6,831.83, reduced to \$3,038.50 by the rebates available through the Home Performance with Energy Star program. The projected annual savings are anticipated to be 170 gallons of No. 2 heating oil. The improvements will reduce carbon dioxide emissions by 4,319 pounds per year and save Debra \$754.87 annually.

Following the energy efficiency work, Debra noticed that the basement was less drafty and the house held heat better than before. "I am really glad this program was available, and I would recommend others to take advantage of it."



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# YOU CAN SAVE \$1,000 ON HEATING

By Mary Lamson

"You have to spend money to make money," or so the old adage says.

In terms of energy efficiency, investing in the home—insulation, efficient heating systems, heat pumps and renewables—is a sure way to make money.

Many energy improvements pay for themselves in five years, typically. After five years the investment earns the homeowner money in the form of heating fuel not burned.

"Many of us can't afford NOT to make the improvements," said Ludy Biddle, director of NeighborWorks of Western Vermont. "Saving \$1,000 on heating makes a big difference in a family's household budget."

The upfront cost to make the improvements is a barrier for some, but it doesn't have to be.

NeighborWorks of Western Vermont has financing to make energy improvements affordable, and designed their energy loan to be easy.

"Our loan is simple, unsecured, and statewide," said Biddle. "Homeowners can borrow up to \$15,000 at a low interest rate and pay it back over ten years or sooner if they wish." Amounts over \$15,000 are also possible with a secured loan.

Vermont homeowners of any income, or working with any contractor, can apply for a NeighborWorks energy loan.

NeighborWorks also offers on-bill repayment in partnership with Green Mountain Power. GMP customers anywhere in Vermont are able to repay their NeighborWorks energy loan through their regular electricity bill, with no separate bill necessary.

"It's one less thing to think about," said Biddle of on-bill repayment, "One less check to write and one less stamp to find."

NeighborWorks is talking with other electric companies in Vermont about on-bill repayment for customers.

What makes NeighborWorks different is their nonprofit mission: to keep their customer's best interest at heart and to find solutions that work for their customer.

Another thing that sets NeighborWorks apart is their one-stop-shop model.

"Customers can come to us for anything," said Biddle. "Need a loan? We can help. Need an energy audit? We can do that, too. In fact, we have programs for people at all points in the home ownership spectrum: home buyer education classes, realty, lending, home repair, even foreclosure help."



NeighborWorks' H.E.A.T. Squad is their program for homeowners who want to address the efficiency of their home.

Homeowners can get energy audits through NeighborWorks H.E.A.T. Squad for only \$100. Audits are professional and certified, and NeighborWorks customers are eligible for incentives from Efficiency Vermont, up to \$2,000.

Audits are performed by a Building Performance Institute-certified professional. The auditor works for NeighborWorks; his or her job is to provide unbiased advice and support, and suggest solutions that make sense for the homeowner.

NeighborWorks will help the homeowner find a reliable contractor if the homeowner does not already have

one they prefer. Some homeowners pay for the improvements out-of-pocket, some tap into their home's equity, and others choose NeighborWorks lending.

"Our customers feel confident that they were

given the best advice and were provided the best solutions for their families and lifestyles," said Biddle.

NeighborWorks™ is the national network of agencies that assist in creating and keeping affordable housing. The program nationally is supported by the US Department of Housing and Urban Development. NeighborWorks of Western Vermont is a nonprofit one-stop-shop based in West Rutland. Their programs include lending, realty home repair and energy efficiency, home buyer education and more. Call 1-877-205-1147 or visit [nwwvt.org](http://nwwvt.org) for more.



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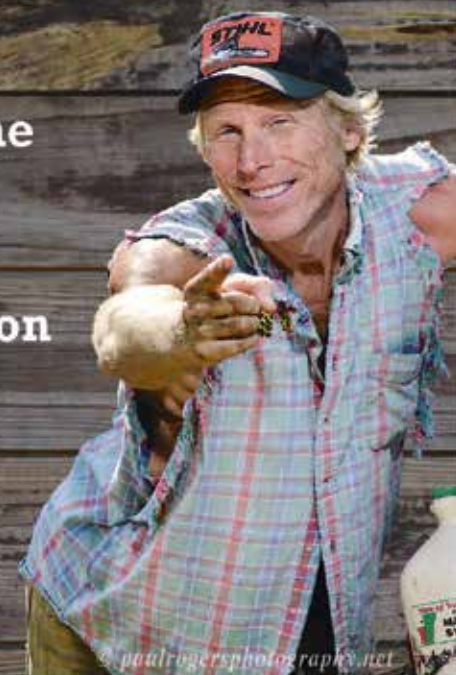
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# Every Fifteen Minutes a Species Dies

By George Harvey

BALTIMORE  
ORIOLE



ily generate many times the amount of power we can use, and power storage is being developed rapidly. New technologies are being developed, as well.

The cost of renewable power has dropped to the point that they are our least expensive power sources. Solar is out-competing natural gas, even in states without solar incentives, and wind usually beats all comers. Grid stability has been proven to be less expensive with renewable power sources than with base-load power plants. Even with low natural gas prices, building a new fossil fuel plant requires justification for the costs involved.

In fact, not only will we stop climate change, but we have a very good chance of establishing ourselves in a far better style of living in the process. Distributed power implies a potential for distributed prosperity.

Not only can we imagine clean air, we can actually bring it into being. In today's world, seven million people die each year from the effects of air pollution, according to the World Health Organization, and many millions more suffer from chronic respiratory problems. In tomorrow's world, we are very likely to have better respiratory health. Cancer may also become less common, as our bodies have less need to fight the toxins they encounter from fossil fuels. There are many other

reasons to end fossil fuel dependence.

This is a war we will win, one that we can all win together, in which all humanity is on the same side (though some do not yet know it).

Given my confidence, you might ask why I work so hard at trying to stop climate change.

Today we are in the middle of what scientists call the "Sixth Extinction." This is a time when a great many species are passing out of existence. It has been nearly twenty years since an article in the peer-reviewed journal, *Science*, projected species loss at 140,000 per year (S.L. Pimm, G.J. Russell, J.L. Gittleman and T.M. Brooks, "The Future of Biodiversity"). At that rate, species were being lost every three and three-quarters minutes. Things have not improved since then.

Of course, scientists differ on how fast we are losing species. I called Nikhil Advani, who works on such questions for the World Wildlife Fund for Nature in Washington DC. He believed 140,000 was a bit high, but even so, species are dying altogether too fast because of global



warming. Even at a quarter of the speed given, we lose one species every fifteen minutes.

Advani said the warming itself does not kill directly. Instead, it drives extinction. "One species we are worrying about is moose, at least in North America," he said. "The slight increase in winter temperatures means that ticks can overwinter where they never had before, and in numbers great enough to cause serious damage. Moose are being killed by ticks." Ticks are disease vectors, as many of us know, but they are already so bad they are killing moose by causing lethal anemia, by bleeding them to death.

The National Audubon Society issued a warning on climate change last year, after conducting a seven-year study. According to them, more than half the species of birds in North America are at risk of extinction from climate change. Among those they listed were the American bald eagle and the Baltimore oriole.

One thing shocking about these species is that none is considered endangered, threatened, or even vulnerable, under current conservation status. They are all listed as being in the "Least Concern" category. Climate change, however, can kill them. And it can kill a host of other species we care about. Furthermore, in addition to species rendered extinct, many will be extirpated from our area, or rendered extinct locally. These include many of the animals, trees, and other plants of our forests. It will be a very different New England, unless we can change things.

There is a lesson here. Even if we are confident that we will stop climate change, we cannot afford to be complacent about it. We have heard the argument that we should delay action, perhaps by "just" two years, until we know the science better and can put more advanced technologies into place. But that translates into 70,000 or more species being utterly lost. Every fifteen minutes we delay dealing with climate change, another species may pass into history.

POLAR BEARS



## The Global Warming Cause Is it from natural forces or is it man-made?

by Roddy Scheer and Doug Moss

Given the preponderance of data showing rising temperatures around the globe in recent decades—along with the increasing frequency of extreme weather events—it's hard to believe there are still any climate change deniers. But a recent survey by the non-profit Center for American Progress found that some 58 percent of Republicans in the U.S. Congress still "refuse to accept climate change." Meanwhile, others acknowledge the existence of global warming but cling to the scientifically debunked notion that the cause is natural forces, not greenhouse gas pollution by humans.

One of the chief doubters in the U.S. House of Representatives is Texas Republican John Carter, who reports on his website that the United Nations' Intergovernmental Panel on Climate Change (IPCC) and the East Anglia Climatic Research Unit in Great Britain—two of the world's foremost authorities on the extent and severity of global warming—hid their own research results showing that world temperatures have not actually been rising, but in fact have been falling, over the past several years.

"We may or may not even be in a warming cycle," says Carter. "Even if we are, scientific evidence does not conclude that activity by man plays any significant role." Even so, Carter supports more research and development of solar, wind, tidal and geothermal energy, along with the continued development of hybrid, natural gas and all-electric vehicles.

Another outspoken climate naysayer in Congress is House Science, Space and



Congressman Lamar Smith (R-TX), chair of the House Science, Space and Technology Committee, calls the Obama administration's 2014 National Climate Assessment -- which squarely pins the blame for global warming on human industrial activity -- "a political document intended to frighten Americans into believing that any abnormal weather we experience is the direct result of human CO2 emissions." Photo: NASA HQ, Flickr CC

Technology Committee chair Lamar Smith, another Texas Republican, who calls the Obama administration's 2014 National Climate Assessment (which squarely pins the blame for global warming on human emissions) "a political document intended to frighten Americans into believing that any abnormal weather we experience is the direct result of human CO2 emissions." He adds that "the Obama administration feels compelled to stretch the truth in order to drum up support for more costly and unnecessary regulations and subsidies."

Of course, the right side of the aisle in Congress isn't the only place you'll

find climate change deniers. In a recent op-ed article that appeared on FoxNews.com, scientist and author Daniel Botkin comments that the 2014 National Climate Assessment "ignores...the real history of life itself: endlessly changing, highly adaptable, and never subject to the kind of stasis that the climate change consensus imagines, wrongly, to be Nature's ideal state." Plenty of other conservative media voices on Fox News and elsewhere are vocal in their skepticism about humans' (leading) role in climate change.

But regardless of how persuasive some of these pundits might sound, the facts speak for themselves. IPCC reports that human influence on the climate system is "clear," with greenhouse gas emissions driven largely by economic and population growth skyrocketing to record levels and leading to atmospheric conditions unprecedented in at least the last 800,000 years. IPCC adds that greenhouse gas emissions are "extremely likely to have been the dominant cause of the observed warming since the mid-20th century" and that warming will be a "very likely" catalyst for increased heat waves, extreme precipitation events, warmer oceans and higher sea levels.

Contacts: U.S. Representative John Carter (R-TX), [carter.house.gov](http://carter.house.gov); U.S. Representative Lamar Smith, [lamarsmith.house.gov](http://lamarsmith.house.gov); FoxNews, [www.foxnews.com](http://www.foxnews.com); IPCC, [www.ipcc.ch](http://www.ipcc.ch).

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## David Blittersdorf's View from the Top Running the Numbers: A Call for Energy Literacy

Energy is the defining issue of our time, and numbers and data form the backbone of discussions about energy. The problem with this is that there are serious flaws with energy literacy in America. Mathematics and statistics are often misunderstood, and can be easily twisted to suit specific agendas. We also lack the education in rhetoric and logic that is necessary to interpret information accurately. Quite often we get stuck considering the species and size of various trees, and we miss looking at the forest: the big picture of how our energy use has changed dramatically over the past hundred years, and will continue to change over the century to come.

Finite resources are extracted or produced at a rate of a normal distribution over time — a bell curve. The American Petroleum Institute is currently running TV ads claiming that the United States is going to be the number one producer of oil, and will thereby become energy independent. This is a massive fiction, because the world has peaked its production of oil, and being reliant on a finite resource does not support energy independence. This is the meaning of peak oil: we are at the top portion of the bell curve, balanced at the apex of the peak production of all of the oil that has ever existed on earth.

We know where all of the oil is, and we won't be discovering any more of it. The bell curve of humanity's use of oil fits within a 200-year period, between the years 1900 and 2100; we are now at the halfway point of this unrepeatable one-time oil boom. How we choose to use our remaining oil will affect the future



Abandoned oil derricks behind an abandoned farm.  
Photo from EPA.

of society on our planet, with respect to climate change as well as energy. So we need to carefully consider the facts, to make informed decisions and hold our leaders accountable. Energy literacy is paramount. We need to be having regular public conversations that result in action.

The total amount of oil that has been or ever will be usable is about 2 trillion barrels. You might think that's a lot of oil, but remember in the years since 1900 we've already used about half of it, and worldwide were currently using over 32 billion barrels a year, and counting. So, let's do the math: a total of 2 trillion barrels ever available, divided in half, equals 1 trillion barrels remaining. One trillion is 1000 billion. One thousand billion barrels divided by 32 billion barrels per year equals a little over 31 years, at the current rate of use. But keep in mind we'll be descending the bell curve, so there will be less oil available year to year, and it's likely we will be stretching out these diminishing amounts for the rest of this century.

Why does all this matter? Our society is hurtling at breakneck speed toward the brick wall of the finiteness of fossil fuels, and we will hit it soon. More than 40% of U.S. energy comes from oil. Depending on a finite and decreasingly available fossil fuel is not a sustainable or smart energy policy, and CO2 emissions keep rising as we burn our way into planetary environmental system collapse.

What is to be done? Let's put the brakes on fossil fuel use. Become energy literate — consider how you use energy to transport, house, heat and feed yourself and your loved ones, and begin to restructure your lives to decrease fossil fuel consumption. We have a golden opportunity, a short period of time in which to make changes. We cannot make more fossil fuels, but we can still choose to conserve what remains. Begin at the personal level, and also engage at the local level: how does your town power its buildings, or run its water treatment facility? Statewide, we need a carbon pollution tax to fund these changes, and we need to push for the same at the federal level. This is not pie-in-the-sky thinking — I speak from pragmatism. Our future depends upon understanding the facts, and having the foresight and fortitude to change our lives.

*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 AllEarth Solar Tracker. He founded NRG Systems in Hinesburg, VT, and is the managing partner of Georgia Mountain Community Wind.*

AND IN THE NEWS...

## AROUND THE WORLD ON SOLAR POWER



Solar Impulse II. Photo by Milko Vuille, from Wikimedia Commons

By Thaddeus Rumble

You can use power from the sun, even when the sun is not shining, with storage options today. Furthermore, you can use it for some pretty intensive applications, such as powering an aircraft in flight. We saw that when Solar Impulse HB-SIA flew well into the night as it crossed the United States powered entirely by solar cells.

Solar Impulse HB-SIB (Solar Impulse II), the second aircraft in its solar-powered series, is about to go on a round-the-world flight entirely powered by sunlight. The 269.5 square meters of solar cells, mounted on its wings, will power four electric motors and store enough power during the day to keep it going all night. This means that it can fly continually, all day and all night, for days on end.

As Green Energy Times goes to press, the Solar Impulse is in Dubai, the beginning and end point of its flight. It is expected to begin its flight in late February or early March. Since it can fly continually, it will be aloft for days at a time, but its slow cruising speed of about 56 miles per hour, means that the journey will take a long time. It will fly with five stops, to allow changes of pilots. The individual legs of the journey will last from three to four days each.

The aircraft is nothing if not impressive. Its wingspan is 236 feet. By comparison, the greatest wingspan on any Boeing 747 model is 224 feet 7 inches, and the eight-engine B-36, the largest combat aircraft ever built, has a wingspan of 230 feet. One aircraft with a larger wingspan than the Solar Impulse II was the Hughes H-4 Hercules, or "Spruce Goose," with its 320 feet. One other difference is that the Solar Impulse II only weighs 5,100 pounds, fully loaded.

Four lithium-ion batteries each provide 13kW to the four electric motors. Its maximum speed is 87.5 miles per hour, and its takeoff speed is 22 miles per hour. Yes, you read that right, 22 mph.

Solar Impulse II is set to cruise at altitudes above any weather that might block the sunlight. The cabin is unpressurized to keep weight down, so the pilot will be provided with oxygen. There is an autopilot, so the pilot can sleep a bit. Still, we might imagine this will not be a particularly comfortable flight. We might think of it the next time we get into a jumbo-jet powered by aviation fuel and want to complain about the flight.

## A Relationship between Form and Energy

Movie Review by G. Harvey and N. R. Mallery

### SUPERHouse! the story of buildings and energy

A film by J.D. Wager, 60 Minutes, SUPERhouseTHEMOVIE.com

SUPERhouse! sets aside the old dictum that form follows function. Part of the reason buildings look as they do is based a direct relationship between form and energy. People will waste energy if it is too inexpensive to consider, regardless of the simple, predictable fact that the price will change, eventually becoming important. And so old-fashioned construction techniques produce energy hogs.

This video looks at building codes, industry practices, the economics of building approaches, and the ever increasing cost of living in a world with a quickly changing climate. Balancing the energy equation is an important step towards more security on our planet, in our nation, and our communities. Buildings use 49% of all primary energy we create.

The passive house building approach can have a profound effect on not only carbon emissions, but also on energy security. Reducing imports keeps more money in the local area and boosts

job creation. For the homeowner, it means low costs, but interestingly also makes the home more comfortable. No large furnace is required, the heating and cooling systems are so simplified that they can be inexpensive and take up very little space.

SUPERhouse! makes it easy to understand the passive house standard. The viewer gets the techniques explained through brief interviews with sixteen experts, among whom are Wolfgang Feist, Bill McKibben, and Alex Wilson. A number of others local to New England also appear. The purpose of the video is to educate a wide audience, creating an awareness of how carbon emissions can be reduced.

Every builder and architect should see this DVD before undertaking any new construction project. In fact, we believe every building permit should require standards for air sealing and insulation based on the passive house standard. There is simply no excuse for continuing construction of energy hogs, when efficient buildings can be built that cost next to nothing

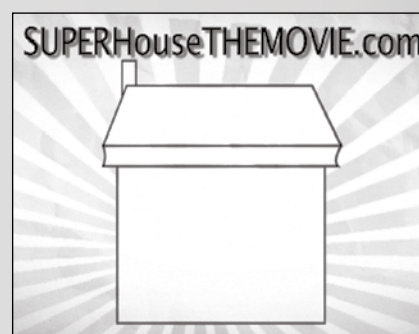
"There has been much discussion about whether a shift to a sustainable energy supply without the need for coal and uranium is even realistic. Passivhaus shows that this shift is feasible and also offers an array of further benefits, not least higher-quality buildings and improved comfort."

—Dr. Wolfgang Feist

to heat and are more comfortable than old-fashioned construction makes possible, and that have construction costs that might even be lower.

We have a large number of existing structures that need to be heated and comfortable and could be improved by deep energy retrofits based on the passive house standard. We have one question, *When is the next movie coming out about how to fix existing buildings?*

To learn more and watch the movie trailer, visit SUPERhouseTHEMOVIE.com.





# GREEN BUILDERS BUILDING ALTERNATIVES

By George Harvey

Bob Tortorice had always wanted an energy-efficient home powered by wind or solar energy, but in 1979, when he decided to get such a house built, he was unable to find contractors who could help him. He solved this problem by building it himself. In time, he would use the experience he gained, doing that and other construction work, to open his own business.

Kathe Tortorice brought her own experience, very unlike Bob's, to the business. She got her BS and MBA at Babson College, well known for its education in economics and finance. She then worked for Digital Equipment Corporation doing process design and strategic planning.

They put their backgrounds together with a fair dose of creativity, and created Building Alternatives in 1986. Bob's background in construction provided the business with its physical product. Kathe's, however, helped form a new kind of business plan, and from that, a customer's experience is different from what it would have been elsewhere.

Building Alternatives takes customers through a series of steps toward a final goal of having their own homes. These are carefully planned to maximize efficiency, both in the building itself and in the process of getting it built. They also enable the customers to make their own decisions about design, materials, and products used in the building. Because customer involve-



This SIP-constructed home was built with structurally Insulated panels, for a highly insulated building envelope..

ment in decision-making is maximized, stress and worry can be minimized.

The first step is that Building Alternative act as consultants. The goal is to get a clear understanding of what the customers' needs are and how they want to live their lives. The options before them are examined, along with the potential effects of choices. "Every home is unique," Bob says. It is a point he makes repeatedly. Different people want different solutions.

The next step is to produce a set of specifications, getting a clear understanding of costs based on customer choices. The customer is directly involved in deciding what materials, technologies, and products are to be used. With such an approach, surprises are reduced to a minimum.

Finally, Building Alternatives guides the process of construction to be as the cus-

tomers desire, providing only the services the they want, building only what the they ask for.

There is one point on which Building Alternatives is inflexible. It is that every home must be Energy Star certified. They insist on building only homes that are as efficient as possible.

Bob and Kathe are the only employees who work directly for the business. They manage building, rather than doing the construction themselves. There are some important reasons why this is an advantage. One is that it means that constructing the home is fully planned; there are no decisions made on the fly during the construction. Another reason this is good is environmental: building crews always work at sites that are local to them, cutting down on transportation time and energy.

Professional management costs less than no management.

Having a business devoted to guiding construction, as opposed to doing it, means that time can be devoted to research. The result is that Building Alternatives is not stuck in the same old-fashioned techniques that worked when Grandpa was young. This means the most modern techniques can be used, updating technology constantly.

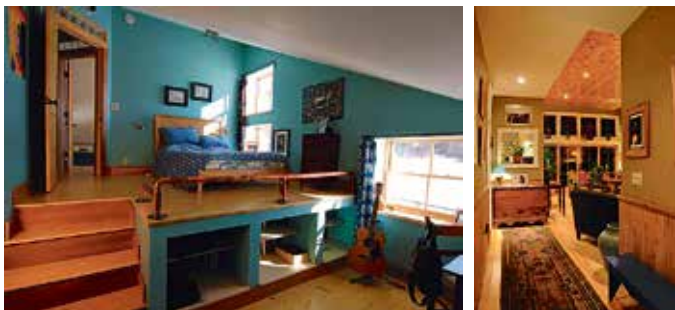
"We believe in manufactured products. Stick-built construction is absolutely the worst way to build a house," Bob says. He points out, however, that every home is unique because the needs of every family are unique. And so, manufactured products have to be used in ways that are appropriate to the circumstances.

Bob is certified as a HERS inspector. He understands the importance of proper insulation and its application. "Forty % of efficiency is air-sealing," he says, and this he knows, based on his experience. Orientation and solar gain are more important in planning than solar panels, which can often even be added off-site after construction is completed.

Building Alternatives really does represent an alternative to traditional approaches of construction, and it is one many people might do well to consider. You can reach them at 603-823-5100, or at [www.buildingalternatives.com](http://www.buildingalternatives.com).

*When I was a child, my father told me stories of his experiences in World War II. Among them were tales of a group of men of almost superhuman stature, called Seabees. They could go anywhere, any time, build anything, and have it ready and waiting for the Marines when they landed. When I learned that Bob Tortorice had been a Seabee, I was not surprised.*

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# DEEP ENERGY RETROFIT WINDOWS

By Michael Goetinck

There is a lot of information about window performance and how it can affect the R-value of the wall assembly, but it boils down to a few things:

1. As soon as you add windows to a wall assembly the performance normally goes down.
2. The more windows you add, the lower the performance of the assembly.
3. The higher the performance of the window the higher the performance of the assembly.

This article will focus on considerations of where to place windows the within the double wall assembly. There are three choices:

1. All the way to the exterior.
2. All the way to the interior.
3. Somewhere in the middle.

Where you decide to place the windows will depend on how much "weight" you give to each of the variables. In addition to performance there are aesthetic choices and ease of installation (or in the case of retro-fits; the ease or difficulty of moving the existing windows).

Installing windows all the way to exterior is the most common method and most windows are designed to be installed in this fashion. The windows will look "right"

from the outside and the flashing and exterior trim details are familiar to most builders. Most people like the deep window sill on the inside especially if the sides of the openings are flared to an angle of 45°. The easiest way to handle the interior trim is to use drywall returns to create the flared extension jambs, although in some situations the flares need to be made from paint-grade plywood in order to attach the window stops. A head jamb that blends into the wall above it and a wood sill makes for a very nice finished look.

Installing the windows all the way to the interior preserves the familiar interior trim details of wood casing. The exterior details include a deeper drainage pan and wider exterior trim. This placement is useful if you want to protect the windows from the elements. I would consider flaring the exterior opening especially if you want to let the most amount of light come into the room.

Installing the windows in the middle gives you the benefits of both of the previous options. It also allows you to increase the thermal performance of the window units by adding rigid insulation to both sides of the unit frame which will reduce thermal bridging across the window frame. Additional advantages are that the windows are more protected from the



Windows in double walls that will be super insulated. Photo courtesy of Bill Hulstrunk, National Fiber.

elements because they are recessed into the wall assembly and you still get the opportunity to have a deeper window sill and flared interior sides. A good rule of thumb is to install the units a third of the way in from the exterior. More time will be necessary to install the window pan, the wider exterior trim, and the interior details of the flared sides and deeper sill.

Michael Goetinck is the owner of Snowdog Construction, Ltd, in Norwich, VT. This series will continue in Green Energy Times, where the author will cover other topics that can help achieve the deep energy measures which help buildings' energy performance, and so can benefit us all.

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## Weatherizing the Statehouse

cont'd from p.1

and the contractors.

I also found that the foundation and walls were not insulated. There is no moisture barrier on the exterior, and if it were insulated, this might potentially create conditions where the masonry walls are susceptible to damage from cycling through freezes and thaws. Further testing would be needed to determine if the walls could be safely insulated.

The attic area was clearly in need of attention, and insulating and air sealing would not only reduce energy loss but help reduce ice dam formations and reduce the migration of moisture. Both of these steps help preserve buildings. The initial thought was to apply spray foam insulation to the bottom of the roof as there were air handlers and duct work in the attic space. After discussions with historic preservation experts, this was ruled out because it would be difficult to remove, if that were needed. The next option looked at was to install an air barrier under the roof and blow in cellulose. This was ruled out due to the high

cost. The final option was to isolate the attic space by air sealing and adding cellulose, and this was clearly the most benign and cost-effective approach.

The attic had many pathways for air to escape from heated areas, some of them unusual. They included gaps around each of the ceiling supply and return ducts, pocket doors, mechanical chases, and attic accesses. The most challenging item was sealing the numerous ceiling lights. They have a three-inch hole in the ceiling and are lowered by aircraft cable to change the bulb. A solution was to use a rubber roof boot to attach to the light with weatherstripping to seal to the ceiling. Montpelier Construction performed the air sealing work and installed house wrap a minimum of six inches away from transition wall areas to prepare for dense-pack cellulose. Energy Efficient Construction was hired for installing cellulose in the walls and the attic "flat." Normally attics are insulated to a minimum of R-49 but out of safety concerns to maintenance workers, the top of the ceiling joists were left exposed, resulting in an average of R-35.

The building was tested with multiple blower doors with help of Efficiency Vermont. At the start of the project the test came in at 33,000 CFM@50 Pa. The post-construction test showed a 10% reduction. Heat savings will be \$2100 per year with a payback of about 10 years not counting savings in air conditioning. An added benefit of the project is the reduction of intrusions by moist outside air during the summer, reducing the dehumidifying requirements.

Common Sense Energy's website is [cseenergyvt.com](http://cseenergyvt.com) Their number is 802- 846-7592. Montpelier Construction's website is [montpelierconstruction.com](http://montpelierconstruction.com). Their number is 802-229-6575.

Allan Bullis is CEM, LEED AP, and Auditing Engineer at Common Sense Energy.



Above: The post-construction blower door tests showed a 10% reduction in heat loss. Heat savings will be \$2100 per year. Right: The most challenging item was sealing the numerous ceiling lights. Photos courtesy of Allan Bullis.

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# THE LOW-HANGING FRUIT INSULATION

## A Series: Part V A Sweater For Your House

By Mark Boudreau

Let's start with the basics, insulation. It resists the flow of heat from one location to another. A good insulator is a material that is really good at keeping heat from transferring from one location to the next.

Take a thermos bottle. You put your hot coffee in the thermos, go out for a ski and in about an hour you stop. Your thermos has been exposed to the 5° temperatures but when you pour your first cup it is still as hot as when you made it. It is a simple concept. The walls of your thermos have resisted the heat transfer that takes place because heat seeks to move from a region of high heat to a region of low heat. The insulation in your thermos keeps the heat in better than, say, a ceramic cup which transfers heat from the hot liquid to the outside surface of the cup to warm up your hands. That heat is leaving the liquid at a much faster rate than the thermos. Resistance is the key word here -- the "R"-value. Different materials resist heat transfer at different rates of time. The ceramic cup's R-value is lower than that of the thermos.

In houses we discuss R-values a lot. In fact there are certain benchmark R-values that we actually try to achieve in different parts of the house. The average house

that our design-build company audits usually has wall R-values of between 10 and 30. Attics' R-values range between 10 and 70. Basement R-values range between 5 and 30.

For your house to stay warm you need to add heat to it. Your heater output is measured as BTU's (British Thermal Units). Over time that heat leaves the house to the outdoors, and generally leaves no matter what you do. You can change how quickly it leaves though. The rate that the heat transfers through the walls, ceilings and basement is determined by the R-values of those areas and their insulation. For houses with low R-values, the heat transfer (loss) happens faster so your heater has to keep adding heat to keep you warm. This is costly to your wallet and to the environment. Having high R-values means the heat that is put into the house stays there a lot longer, requiring less heat to keep your space warm for longer time.

There is a fairly wide variety of insulations on the market. There is no best insulation. Each insulation has its pros and cons. The chart to the right includes the most common ones and their R-values.

Remember that insulation is only as good as the air-sealing that is done in

Insulation System	R-value per inch	Pros	Cons	Best Use
Cellulose: Shredded newspaper	R-3.7/inch (loose blown) R-3.2/inch (dense pack)	Recycled paper, green product, dries well and resists mold and rot. Inexpensive. When the house's life-cycle is over it will decompose easily.	Cannot be used in all situations. Requires a lot of area/volume to get higher R values. Requires a very good airtight seal.	Wall cavities, attics, roof cavities
Spray foam insulation. Polyurethane based foam product that is sprayed as a liquid and quickly cures as a solid foam. Also comes in preformed rigid foam boards of many varieties which can be used in insulation of walls, basements and attics.	R-5-6/inch	Outstanding airsealer and insulator. Excellent ability to get into hard to reach areas and applies well to uneven surfaces	Requires specialized equipment and installers. Is expensive. Is not environ-mentally friendly. Will not decompose easily after the house's lifecycle is complete. A product of its burning is cyanide gas.	Stone wall basements, difficult to reach places in a home where airsealing and insulation would be very difficult or costly.
Mineral wool insulations. Molten mineral spun into fibers.	R-3/inch	Very good insulator. Greener product than fiberglass insulation. Inexpensive	Great care must be used in installation as any voids or compression will DRASTICALLY reduce r-values	Walls and attics
Fiberglass Insulation. Molten glass spun into fibers.	R-3/inch	Very good insulator. Not particularly environmentally friendly. Inexpensive.	Great care must be used in installation as any voids or compression will DRASTICALLY reduce r-values	Walls and attics

the house. A VERY COMMON MISTAKE is for people to add insulation in their attic but not do any air-sealing. You can have 20 inches of fiberglass insulation which you would expect to give you R-60, but if the insulation is installed poorly or if you have not air-sealed the attic well you may end up with an "effective" or actual R-value of around R-14 for that 20 inches of fiberglass. Air-sealing and Insulation should always happen together. Like the winning combination of a warm sweater and a great windbreaker your insulation will keep that heat in your house, keep you comfortable and keep your heat sys-

tem from working as hard as it otherwise would.

Consult with an energy consultant or home performance professional to help you decide which insulation is the best for you, your values and what you are trying to achieve.

Mark Boudreau is co-owner of Lewis Creek Company, a full-service design-build company consisting of both trades-women and men located in North Ferrisburgh, VT. Their holistic approach to new building and renovating considers people, homes, the environment, beauty, economy, and performance.



Fiberglass poorly installed reduces the R value. Photo and chart courtesy of Mark Boudreau.



Cellulose Dense Packed Into Walls and Spray foam applied to a Ceiling. Photo courtesy of Mark Boudreau.



Close up of Spray Foam Insulation Cured solid. Photo courtesy of Mark Boudreau.

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# THE 90% PASSIVE HOUSE

By George Harvey

Some months ago, architect Robert Scarano of Bright 'n Green told us something in an interview that really made us sit up and exclaim. "You can get 90% of the way to the passive standard for the same cost as conventional construction," he said. He then explained, "The extra cost of insulation and air sealing is offset by the cost saving of not having to install a furnace and chimney."

We brought the idea up with Bob Irving, of R. H. Irving Homebuilders. He says following the passive standard strictly can be expensive, so many builders are adapting elements of the passive standard, finding ways to get superior performance at reduced cost. He builds to about 75% reduction in energy consumption. "From there, it is usually not hard to get to a net-zero energy home with photovoltaic panels," he said.

Irving said the most important consideration is air movement through the house. A typical existing, conventionally built home has extensive air leaks between the sill and the foundation. "You might not see them, but that does not mean they are not there." Hollow interior walls act like chimneys, if there is any way for air to get into them from the basement and escape from them into the attic. Wiring, plumbing, and other penetrations provide a perfect pathways for the air to get through. This can be avoided by finding and sealing the leaks. It is best to get an energy audit, including a blower door test.

One of the most important things to learn from the passive standard, Irving says, is the idea that everything to be heated should be within the sealed and insulated building envelope. If the attic is to be considered part of the living area and heated, it should be within the envelope; otherwise, it should be outside. Everything, including basement walls and

attic access ways should be insulated and air-sealed.

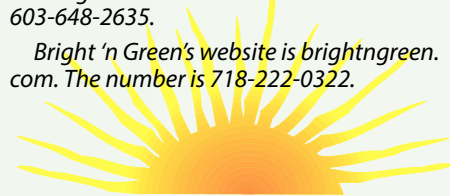
There should be no thermal bridges. A thermal bridge conducts heat through insulation. For example, in conventional construction, if the exterior wall sheathing and interior plaster are attached to the same studs, the stud is a thermal bridge, giving heat an opportunity to bypass the insulation between the studs. One way of preventing this is to have the exterior and interior walls on different studs; they are not connected, and there is insulation between them, making a double wall. In Irving's building, the studs for outside wall are load-bearing, and the studs for the inside wall are not.

Ventilation is of utmost importance. Irving's buildings are equipped with heat exchangers so incoming fresh air should be raised close to room temperature by heat exchangers capturing heat from air venting out. Scarano's buildings have incoming air that passes through underground pipes to pick up geothermal heat, bringing it close to room temperature before getting to the buildings' interiors.

Unsurprisingly, insulation and high-performance windows are important issues. What is surprising, however, is that when a house is really well insulated, the heat distributes through the house far more easily than it gets outside. Thus, a small number of heating distribution points can supply very even heat throughout a house, even to rooms that do not have their own heat sources. A well-built house should be both inexpensive to heat and comfortable.

R. H. Irving Homebuilders' website is [rhirvinghomebuilders.com](http://rhirvinghomebuilders.com). The number is 603-648-2635.

Bright 'n Green's website is [brightngreen.com](http://brightngreen.com). The number is 718-222-0322.



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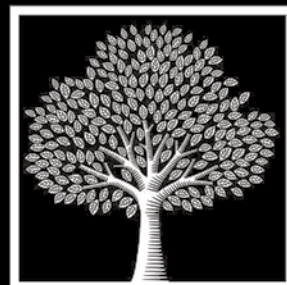


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## Sustainable Textiles

By Green Energy Times Staff



Some of us make a point of buying hemp or organic cotton garments because we know how bad pollution and health problems associated with synthetic fabrics are. While "going green" by looking at a garment's tag seems easy, the reality of textile production is very complex.

The fiber in most hemp and organic cotton garments found in this country is grown and processed on the other side of the world. Most natural fibers include chemicals with such health hazards as formaldehyde solutions, pesticides, and synthetic dyes.

A movement supporting local people for local textiles, similar to support for farmers' markets and local businesses, has been growing for a decade or more. This has been going on as new fiber processing mills, making yarn from local fiber, have sprouted up across the nation.

Ishana Ingerman, a Vermont designer, has taken up the challenge of reestablishing a regional textile industry. She started with a Kickstarter fundraiser, in hopes of showing what can be done in New England. The project, called Winter Moose, touches on a wide variety of artisans and small businesses. It was successfully completed in January.

Winter Moose will start by purchasing yarn made with Vermont fiber, from a Vermont processing mill. Some yarn will be left its natural color, and some will be dyed by local dyers who grow their own dyes or use plant dyes grown in this country. When the yarns are ready, several weavers in Vermont will make samples of different kinds of fabric. When the weavers return the woven samples to Ingerman, she will direct the finishing processes and testing. Finishing processes can shrink a woven fabric by half, adding water resistance and durability. When the small samples are finished, the first run of cloth can be manufactured.

The plan is to use a Vermont carding and spinning mill that can organically process the fibers that Ingerman has gathered from Vermont alpaca and sheep farmers. Vermont hand weavers will weave dozens of yards of textiles, while Ingerman sources the most effective way to finish larger quantities of cloth. She and

her daughter have designed coats, hats, and bags that will be made from the cloth, and she will make the initial patterns for each item.

The patterns and cloth will then be passed to local professional seamstresses and stitchers, who will cut and sew the garments. Handmade wooden buttons will be supplied, as will 100% organic cotton lining, grown and processed in this country, if possible. Zippers, threads, and other notions, if they cannot be found in Vermont, will be made in America.

A large part of this project is organizational. It requires connecting masters and experts who have never worked together before.

It is however also educational. Ingerman plans to gather information about new technologies that may aid in traditional processes. She plans to support, wherever she can, environmentally sound practices, efficient cross-sector interfaces, skills training, and consumer education.

Ingerman also hopes to attract new talent and skills to the industry through the Refugee Resettlement Program in Vermont. She believes the Winter Moose project may provide career opportunities by connecting and expanding the present fiber to fashion industry of Vermont, and eventually, New England.

Ishana Ingerman's web site is [www.wintermoose.com](http://www.wintermoose.com).

Excerpts used with permission from Ishana Ingerman's, "Sustainable Cloth: A Vermont designer takes up the regional textile challenge." copyright 2014



## COMPOST-HEATED GREENHOUSES and the Compost Heat Wagon



top: The compost heated greenhouse at Jasper Hill farm in Greensboro, Vt.  
left: The seedbeds in the compost heated greenhouse at Jasper Hill farm are kept at 70F throughout the winter by compost-aeration system being exhausted into pipes under the soil.  
below: 170F temperature gauge of aerated compost pile at Vermont Compost. All photos courtesy of Agrilab Technologies.

By Gaelan Brown

Properly managed compost gets really hot. Experienced composters know that pile temperatures can exceed 160F if the material is properly aerated. You may have wondered if there are ways to capture that heat in a cost-effective way, and the answer is yes.

This winter both Vermont Compost Company and Jasper Hill Farm are heating large greenhouses through Vermont's harsh winter entirely with energy captured from compost. These systems are capturing up to 1 million BTUs of energy per ton of material composted, saving thousands of dollars on heating and hot water fuel and enabling year-round vegetable growing in Vermont.

A ton of quality compost can sell for \$30 to \$100 depending on how it's marketed. And one million BTUs of energy captured per ton is worth up to \$35 in terms of replacing propane, electricity or fuel oil. By comparison, the energy value of a ton of coal is \$30.

Recent advances in compost heat recovery are the result of many years of research and collaboration among organizations like Highfields Center for Composting, CompostPower.org, Yesterday Design/Build school, Agrilab Technologies, Acro Labs, Ltd, Bruce Fulford, Vermont Compost Company, and the Universities of Vermont and New Hampshire and others.

The keys to success have been new methods of managing aeration of the compost to keep the microbes happy and hot, combined with innovative heat exchangers. The result has been predictable cost-effective heat recovery and improved compost production processes in general.

Two critical factors for commercial, municipal and farm-scale compost operations are managing aeration and controlling odors. Turned windrow or other mechanical tumbling methods of aerating the compost are expensive in terms of equipment and energy costs. And a few days after material is turned it usually

goes anaerobic, meaning there's not enough oxygen to keep the composting microbes happy, which causes problems in terms of compost temperature, quality and odors.

Aerated static pile (ASP) composting uses fans to move air through the material via pipes or channels underneath it. ASP composting ensures that material is always being properly aerated, maintaining ideal conditions for the thermophilic composting that kills pathogens and weed seeds and breaks material down quickly. ASP has been shown to use less than half of the energy of turned windrow operations, with better speed and quality results.

Negatively aerated static pile systems (pulling air down through the top of the material into channels underneath it) enable heat to be captured by running the hot vapor pulled from the compost through a heat exchanger. Negative aeration also supports easy ways to capture CO2 emissions and odors from compost.

At Jasper Hill the negative aeration compost heat recovery system is exhausted into a simple bio-filter inside the greenhouse, so that the CO2 emissions from the compost feed the plants while the compost odors are captured. This reduces the amount of cold fresh air that must be brought into the greenhouse for CO2 replenishment, which is essential for plant growth.

Cont'd on p.31





# EMERGING FRONTIERS IN BIOENERGY

# BIOMASS TO BIOFUELS

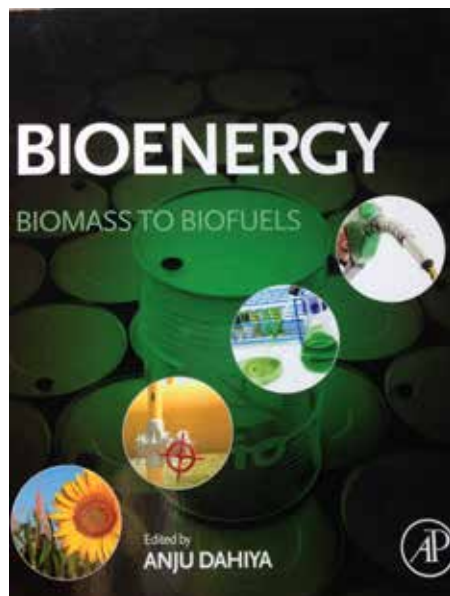
## the new introductory textbook

By Austin Robert Davis

*Bioenergy: Biomass to Biofuels* is an innovative new textbook that provides insight into the potential and current advances and benefits of biofuel. Contributions include an extensive list of well-respected university extension programs, such as The University of Vermont Research Extension 1, as well as numerous national organizations including the US Department of Energy's National Renewable Energy Laboratories 2. The text is edited by Anju Dahiya, cofounder of General Systems Research, LLC 3 and lead biofuels instructor at the University of Vermont's Rubenstein School of Environment and Natural Resources 4, both of which stand as leaders in cutting-edge topics such as microbial fuels and biogas. The chapters of the book are divided into solid, liquid and gaseous biofuels, and further explore cost-effective production as well as discussions covering economics, environment and policy.

Organized into seven accessible sections, *Bioenergy: Biomass to Biofuels* begins with an in-depth overview of the transformation of biomass into biofuels. Once the basics are covered, readers move on to the technical applications of solid feedstocks, such as wood and grass, and their transformation into biofuels. The following section discusses biomass to liquid biofuels—text focuses on oilseeds, cellulose ethanol, and algae as feedstocks. Anaerobic digestion is explored in a section outlining gaseous fuels and bioelectricity and focuses primarily on livestock manure feedstocks. Throughout the chapters, the tradeoffs and benefits of these different feedstocks are outlined through deeper analysis.

Multiple chapters focus in detail on conversion pathways for cost effective biofuel production. The myriad of topics include basic biodiesel production efficiency, converting petroleum-based infrastructure into "biorefineries," reducing enzyme cost through varying combinations, and sustainable aviation biofuels. The text concludes with a robust section that connects biofuels to a big picture perspective—economics, sustainability,



environmental implications, and policy are examined closely in relation to renewable resources, future uncertainties, and entrepreneurship.

*Bioenergy: Biomass to Biofuels* is structured to meet the needs of professionals finding their way in the field, students in need of an introduction, and instructors establishing a course on biofuels. Case studies on provided topics are found at the end of every section and are based on documented implementation projects. *Bioenergy: Biomass to Biofuels* is available for purchase on the Elsevier publisher website. Editor Dahiya, owner of General Systems Research in Burlington, Vermont is a Vermont Bioenergy Initiative grant recipient to advance research and applications of converting algae into biofuel.

Austin Robert Davis is an intern with the Vermont Bioenergy Initiative. Learn more at [www.VermontBioenergy.com](http://www.VermontBioenergy.com).

- 1 <http://www.uvm.edu/~adahiya/bioenergy/?Page=projects.html>
- 2 [www.nrel.gov](http://www.nrel.gov)
- 3 [www.gensysresearch.com](http://www.gensysresearch.com)
- 4 [www.uvm.edu/rsenr/](http://www.uvm.edu/rsenr/)
- 5 <http://store.elsevier.com/Bioenergy/isbn-9780124079090/>

## COMPOST-HEATED GREENHOUSES

Cont'd from p.30

Vermont-based Agrilab Technologies and Acro Labs in Canada developed the patented process with negative aeration and heat exchangers for compost heat recovery systems like the ones at Jasper Hill Farm and Vermont Compost Company.

The new mobile version of Agrilab's system, the Compost Heat Wagon, is now running at Vermont Compost. The Compost Heat Wagon is a space-efficient and mobile "plug-and-play"-style compost aeration and heat recovery system that can capture up to 150,000 BTUs per hour continuously. It includes a high power aeration fan with variable-speed drive and computerized controls, data monitoring, condensate collection and the heat exchange system that makes hot water which is used for space heating or washing.

Hot water from the Isobar heat exchanger is circulated from the Compost

Heat Wagon to two 350-gallon tanks in Vermont Compost's greenhouse. Heat loss from the tanks adds warmth to the greenhouse and water from those tanks is circulated into radiant heated seedbeds and irrigation lines.

Since the Compost Heat Wagon is mobile it's easy to setup quickly, and it comes with lease-to-own financing options from multiple banks. Other Agrilab systems that have been operating for several years are capturing up to 200,000 BTU per hour continuously through winter months from relatively small 200-ton compost piles.

Compost heat recovery is a simple concept for cost-effective base-load renewable energy that doesn't need subsidies to have great economics. For more information about compost heat recovery, visit [www.compostpower.org](http://www.compostpower.org), [www.agrilabtech.com](http://www.agrilabtech.com), or search for the book "The Compost Powered Water Heater" by the author of this article, Gaelan Brown.

# Worm Composting at Home!

## IN 6 EASY STEPS

By Grace Dunklee Cohen

As promised in the December 2014 issue of *Green Energy Times* (p. 31), worm composting expert Joan O'Connor offers a simple recipe for setting up your own worm composting system at home. Composting bins for worms can be set up at any time of year. When done right, they are odor-free, easy to maintain, and turn your kitchen scraps into rich compost. To be productive, Joan cautions that your worms should be kept at 60° to 80° year round. To get started, just follow Joan's simple steps:

### 1. Assemble your Ingredients

- Plastic storage bin 8 to 18" deep
- Shredded newspaper – enough to fill the bin 4 to 6" deep, to be applied in two layers
- Moistened (but not drippy wet) peat moss – enough to fill the bin, one to three inches
- Fine, flexible screening for bottom of bin
- Landscape cloth for top of bin
- Elastic or large bungee cords to secure screening around top of bin
- One pound red wiggler worms
- A half gallon of kitchen scraps such as fruits & veggies, tea bags & coffee grounds, egg shells, beans, pasta, rice, bread, cereal, paper towels, paper plates – no meat, fats, citrus, vinegar or pet waste



### •• INSTRUCTIONS ••

**2. Cut two or three 1" drain holes** in the bottom corner of the bin. Set flexible fine screening over the holes. Add 1-3" of shredded newspaper to the bottom of bin.

Cover the newspaper layer with one to three inches of moistened peat moss. Cover this with a layer of another one to three inches of shredded newspaper.

**3. Dig a hole** in one corner of the newsprint and peat moss. Add one pound of red wiggler worms. Cover with peat and shredded newsprint (to prevent odors).

**4. To feed the worms**, pull back the newsprint and peat, and add kitchen scraps. Put the kitchen scraps on top of the worms the first time, then alternate placing scraps into each bin corner. Since worms only eat after food begins to break down, you can optionally speed up the process by blending scraps into a worm 'smoothie'. Always recover scraps or 'smoothie' with a layer of peat and paper to prevent odors.

**5. Cover the bin** with flexible screening or breathable landscape cloth. Tightly fasten with bungee cords or elastic to prevent worm escapes.

Place the bin on a tray to catch the nutrient-rich drips ('tea') - if your bin came with a lid, the overturned lid will probably work well.

**6. To maintain** happy, productive worms, regularly check that your bin isn't too moist or too dry. When worm castings (poop) build up in your bin, use them as a top dressing on plants, mix with potting/garden soil, or steep them in water for extra-rich "compost tea" to spot-water house plants and jump-start seedlings.

For more information, visit:  
<https://joansworms.wordpress.com/>

Joan O'Connor is founder/director of both the Tilton (NH) Winter and Summer Farmers' Markets, and is a board member of Northeast Organic Farming Association of New Hampshire. Since 1992, O'Connor (aka Joan's Famous Composting Worms) has been practicing and preaching vermicomposting – using earthworms to convert organic waste into fertilizer.

Learn more about vermicomposting in the next issue (February) of *Green Energy Times*. Joan O'Connor will share step-by-step details on how to get started.





# CENTER FOR CLIMATE PREPAREDNESS

ANTIOCH UNIVERSITY, KEENE, NH

By George Harvey

Even if we could stop greenhouse gas (GHG) emissions today, the climate will continue to change over coming decades. The reasons for this are complicated, but at the same time easy to understand. It takes time to heat up a planet, and the effects of carbon emissions we produce today will not be fully felt for many years.

Efficiency and switching to renewable energy sources are not sufficient to stop climate change, though we can mitigate the worst effects. Even if we are completely successful with our efforts, the climate will still change to some degree. We have to be prepared for whatever comes, and that is why resiliency is important.

If we become skillfully resilient, to be able to recover easily from whatever buffeting nature gives us, we will be able to maintain comfortable and happy lives in the future. Developing that ability means we need to understand the facts about what confronts us.

Last March, President Obama launched the Climate Data Initiative to support the Climate Action Plan so we could develop the skills for resilience. He invited sixteen organizations to participate in the launch, government agencies like NOAA and NASA, and corporations expert in data processing like Microsoft, Intel, Google, and Amazon. Among them, one name stood out rather distinctly. It is Antioch

University New England (AUNE).

AUNE already had a decade of experience in climate adaptation research and had done extensive modeling based on climate data, so a person really familiar with the organization would possibly not have been surprised by its inclusion in the effort. Its response to the President's efforts was to open the Center for Climate Preparedness and Community Resilience (CCPCR) in Keene, New Hampshire.

CCPCR's co-director Michael Simpson explained the center's program in terms of a Venn diagram, consisting of three overlapping circles, labeled "Education and Training," "Applied Research," and "Stakeholder Capacity Building." Each circle has an area that is its own. Each overlaps with both of the others. In the center is an area that is in all three. The CCPCR's area of interest is all three, whether independently or in combination.

The point, of course, is to build a capacity for resilience at the community level. This relates to many things. The energy supply is one, both in terms of electricity and for fuels. Others include range from the ability to repair infrastructure damage to the supply of food.

One area of interest illustrates how complicated this is. Simpson said that while the health factor is talked about, it has not been completely detailed. We have heard about the movement north

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of Lyme disease, encephalitis, and West Nile virus. We may even have heard about the problems relating to heat islands in urban environments. There are, however, other aspects of health that are not often discussed. For example, psychological problems can arise out of a number of different kinds of trauma, ranging from post-traumatic stress following extreme storm events that result in loss of property and livelihood or the feeling of helplessness in light of what seems a global change that is out of our control. We have to be prepared for such challenges.

CCPCR has eight people involved. Four are students in programs leading to master's degrees. One is a doctoral fellow. There are three faculty, in addition to Michael Simpson. Compared to programs

elsewhere, that might be very small. The reach of the Center's work is far afield, with research projects in Minneapolis and involving stakeholder capacity building from the Maritime Provinces and down the eastern seaboard and into the Gulf of Mexico. They also work on many issues, ranging from maintain resiliency of our watersheds and coastlines with a focus upon social justice and the most vulnerable populations. All of this relates to the Center's core mission of strengthening communities to prepare, respond and recover in the face of climate impacts, and other disruptions, through collaborative, innovative solutions.

Asked how they can do so much, Simpson said, "We leverage our resources with

*Cont'd on p. 33*



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# VT LAW SCHOOL SOLAR RFP AND CAMPUS SUSTAINABILITY EFFORTS

By Annika Kolasa



Samesun of VT installed the 23kW solar system on the Fitness Center last year. The Energy Clinic at Vermont Law School. Photos courtesy VLS.

In response to a December 2014 request for proposals, Vermont Law School received seven offers from regional solar energy developers to construct and own a 500-kW solar installation whose net-metering credits and associated renewable energy credits would be sold to VLS for the next 20 years, significantly reducing campus electric greenhouse gas emissions. In line with the school's sustainability commitment, this contract would meet half the school's electricity needs through solar energy. Based on the proposals received, a 20-year solar net-metering contract would both reduce the campus electric bill and, more important, reduce

the VLS, as well as Vermont's carbon footprint. The RFP was drafted by students (including the authors of this article) at the new VLS Energy Clinic, a pro-bono energy law and policy clinic, staffed by JD and masters students, that provides policy advice to groups looking to advance the economic and environmental benefits of community-based solar in Vermont. The Energy Clinic is part of Vermont Law School's decade-old Institute for Energy and the Environment and top-ranked Environmental Law Center.

VLS's proposal would allow it to own, with the intent to retire, the renewable energy credits, while the developer chooses a site and maintains ownership of the solar array. The 500kW array need not be on campus to qualify – any array of up to that capacity tied to the Green Mountain Power grid is eligible to receive net metering credits, which the school will use to offset its electricity requirements. Ownership of the Renewable Energy Credits (RECs) is an integral part of the RFP. For each unit of energy produced, one

unit of an "environmental attribute" is created at the same time – a REC -- a tradable commodity valuable to electricity providers trying to meet their states' Renewable Portfolio Standards. If these RECs are sold out of state rather than retired by the end user, those purchasing the net-metering credits, according to accepted greenhouse gas accounting, receive the less-environmental attributes of the residual mix of the New England grid and not low-carbon solar energy. Purchasing net-metering credits without the RECs would increase both the VLS (and Vermont) greenhouse gas emissions.

The VLS solar RFP is part of a larger campus sustainability planning effort. In 2012, Dean Marc Mihaly signed the American College and University Presidents' Climate Commitment. That same year, VLS was able to create a Green Revolving Fund, with a \$200,000 contribution from an anonymous donor, \$50,000 from the Board of Trustees, and later a \$10,500 contribution from the 2013 Class Gift. The fund finances projects that reduce campus greenhouse gas emissions. During the 2013-14 academic year, the Campus Sustainability Committee, which oversees the fund, completed a greenhouse gas inventory documenting emissions for the

campus. Including transportation, heating fuels, and electricity, the school is responsible for 1 million pounds of CO2 per year.

In addition to the solar RFP, VLS has installed two on-campus solar arrays, at the entrance to campus and on top of the student fitness center, for a total of 33kW. The green revolving fund has also financed seven electric vehicle charging ports, the replacement of campus parking lighting with more efficient LED lighting, energy audits on the most inefficient buildings on campus, and building envelope insulation – all priority projects identified in the energy audits. Over the life of the projects, 100% of the project costs are returned to the green revolving fund to support future green investment. Students have also done their part to fight climate change and pollution, passing a student resolution to ask the trustees to look into divesting from fossil fuels.

Annika and Jacinta Ritchie co-authored the RFP. Both are members of the VLS Energy Clinic and 2015 Juris Doctor degree candidates at VLS with a concentration in energy law.



A dual GE Durastion Level 2 electric vehicle charging station on the VLS campus. This is one of seven charging stations at Vermont Law School.

## CENTER FOR CLIMATE PREPAREDNESS

Cont'd from p. 32

those of the stakeholders." The efforts of a small group of informed and dedicated people can move a large number of organizations to action.

One organization in New England CCPCR has worked with is the Upper Valley Adaptation Workgroup (UVAW), whose web site can be found at [uvaw.uvlsrpc.org](http://uvaw.uvlsrpc.org). UVAW has a mission that is very close to that of CCPCR, and provides an avenue to distribute expertise and data to local communities and businesses.

As it happens, Keene, New Hampshire, where AUNE is located, is a leading city in the resiliency movement. Keene started working on resiliency in 2000, when it contacted ICLEI - Local Governments for Sustainability. Keene is also working closely with CCPCR to advance its program. As has been pointed out, however, CCPCR works with many organizations over a wide area.

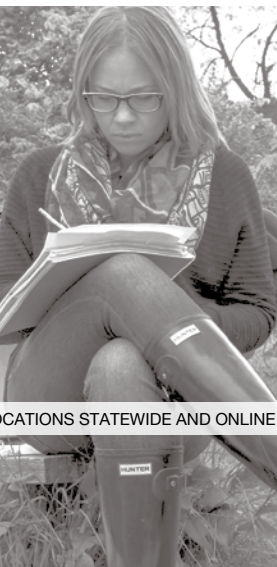
We urge those communities and organizations not yet active on resiliency to become so soon for the well-being of those whose lives they touch. For information, visit the CCPCR web site: [www.communityresilience-center.org](http://www.communityresilience-center.org).

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RESOURCES

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

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

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

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

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

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

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

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

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

**Efficiency VT:** This is a must go to site for immeasurable amounts of info. [www.efficiencyVT.com](http://www.efficiencyVT.com)

**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)

**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)

**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)

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

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

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

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

**Fossil Fuel Freedom:** Group working to make Vermont's energy plan 100% free of fossil fuels:  
To join this group go to: [groups.google.com/group/fossil-fuel-freedom-](https://groups.google.com/group/fossil-fuel-freedom-)

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

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

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

**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)

**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)

**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)

**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)

**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)

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

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

**SEIA/ Solar Energy Industries Association:** The SEIA Tax Manual to answer your solar related tax questions. [www.seia.org](http://www.seia.org)

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

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

**Solar Living Source Book:** [realgoods.com/solar-living-sourcebook](http://realgoods.com/solar-living-sourcebook)

**Solar Store of Greenfield, MA** Stock & install a wide variety of solar & environmentally friendly technologies. [SolarStoreofGreenfield.com](http://SolarStoreofGreenfield.com)

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

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

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

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

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

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

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

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

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

[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...

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JOINT LEGISLATIVE SUSTAINABILITY RESOLUTION

By George Plumb

The terms "sustainable" or "sustainability" are often used now, as well they should be in these environmentally challenging times, but those terms are rarely defined by the users -- never mind in a scientific way with meaningful parameters. Fortunately the Vermont legislature is considering a resolution that would do this. Part of this resolution is below and the whole resolution can be found on the Legislative web site at <http://legislature.vermont.gov/>

Consider urging your legislators to approve this non-binding but very important resolution.

Offered by: Representative McCormack of Burlington

"...Whereas, "sustainable," as defined comprehensively, means that persons living in a politically or geographically defined area: (1) do not live beyond the limits of the local renewable resources for either input (energy and matter) or output (food, material goods, and absorption of pollution); (2) purchase or trade from environmentally conscious sources for those necessities that cannot be locally satisfied; and (3) live both in numbers and in a manner that allows present and future generations of all life in that area to exist in a healthy habitat, and ...

Resolved by the Senate and House of Representatives:

That the General Assembly urges all government agencies, enterprises, institutions of higher learning, and nongovernmental organizations in Vermont that have sustainability as part of their mission or programs to adopt this resolution's definition of "sustainable" and to implement policies and actions to achieve true sustainability..."

*George Plumb is the Executive Director for 'Vermonters for a Sustainable Planet' (VSP). Learn more at [www.vspop.org](http://www.vspop.org).*

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# Ingredient of the Month

By Larry Pleasant

## BRAIN HEALTH 101

I will quote Woody Allen, "My brain! Why that's my second favorite organ!"

This article is the first in a two-part series on maintaining a healthy brain in modern times. Twenty-first century humans require super nutrition to maintain healthy brains! Alzheimer's, ADHD, and autism are just three of the modern-day plagues descending on our modern-day human brains. Fortunately you can fight back with super nutrition.

Let's jump right in with one of my favorite brain foods: Nutritional or brewer's Yeast. They are a little different, but for this article we will use the term nutritional yeast as a catch all for both.

Nutritional yeast is what they make B vitamins from, and it contains trace minerals that we all need to stay optimally healthy. It is a complete protein (18 amino acids!) and does not contain any sugar, dairy, gluten etc. The stuff at most co-ops has added B-12 and is really cheap. A year's supply is about \$15. I love it on popcorn and on my eggs for breakfast. Tastes kind of like cheese!

I came of age in the 1970's and watched a lot of my friends blow out their brains with powerful shamanistic substances. Some did not come back quite the same. During this time I was a vegetarian yogi and dirt poor. I drank a quarter-cup of nutritional yeast with a pinch of cayenne pepper and kelp as a broth every morning and credit this regimen with the survival of my brain cells. The niacin in nutritional yeast can make you flush red so don't panic if this

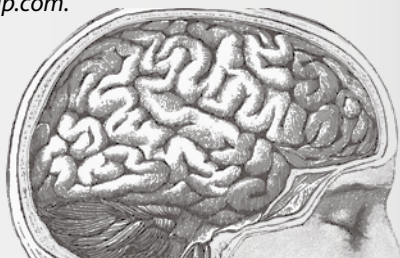
happens. Look up "niacin rush" online for more information. Some people believe this is healthy. Others are not so sure. You have to take a lot of yeast to get enough niacin for a flush (about a third of a cup depending on your body mass) so most people never see it.

Nutritional yeast contains water-soluble stuff that we use and use up quick so it is a good food supplement to take daily. However, if you are on MOA's (including depression medicine) you will have to pass it up as the natural tyramine in these food yeasts can interfere with your meds.

De-activated yeast products (they will NOT ferment in your belly or give you candida) also contain selenium, magnesium and other trace minerals necessary for optimal health. So go ahead and give it a try! Your brain (and the rest of you) will thank you for it.

This is The Soapman reminding you that beautiful skin begins from within!

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



## \$270,000 awarded for Clean Energy and Food Scrap Recycling

From the VT Dept. of Public Services

As announced on January 21, 2015, Casella Resource Solutions and Grow Compost have both been awarded Clean Energy Development Fund grants (\$139,000 and \$131,549 respectively) from the Vermont Public Service Department (PSD) for two pilot projects to demonstrate the anaerobic digestion of food scraps.

PSD collaborated with the Agency of Agriculture, Food and Markets (VAAFM) and the Agency of Natural Resources (ANR) to design the program and develop the agreements with the two companies. PSD also worked with Green Mountain Power who contributed \$70,000 of refunded nuclear insurance monies to allow the PSD to make it possible to support the two projects to advance statewide renewable energy and recycling goals.

Both projects will use funds to collect and process leftover food scraps from businesses and institutions and deliver them to farm-based anaerobic digesters where they will be used to produce heat and power. Casella will bring material to the digester at Blue Spruce Farm in Bridport and Grow Compost is delivering to Vermont Technical College's digester in Randolph.

"To meet our state's energy needs we need to find sources of sustainable and environmentally sound power. The Public Service Department is pleased to be able to support not only renewable energy generation, but also on-farm anaerobic

digestion and food scrap recycling," said Christopher Recchia, Commissioner of the Public Service Department.

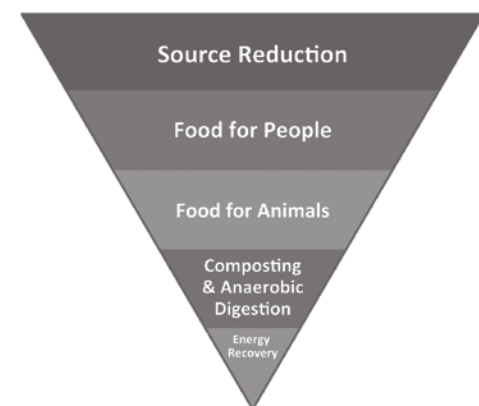
"Vermont agriculture has led the nation in many ways. For instance, we have more on-farm manure digesters compared to

our number of cows than any other state. These two pilot projects will help create a new model to guide how food scraps can be used as a safe and valuable resource for farmers who operate digesters, keeping Vermont's farmers at the forefront of renewable energy," said Chuck Ross, Secretary of the Agency of Agriculture.

"These are two great projects," stated Deborah Markowitz, Secretary of the Agency of Natural Resources. "Vermont's Universal Recycling law sets the stage for Vermonters to take valuable materials – like food scraps – out of our waste stream. Anaerobic digestion will let us use these materials to produce heat and power. What a great way to demonstrate the multiple benefits from recycling our natural resources: projects like these not only produce renewable energy, but they save on our limited landfill space, they promote clean water and help us fight climate change through reduced greenhouse gas emissions."

For more information about Universal Recycling, visit [www.recycle.vermont.gov](http://www.recycle.vermont.gov) or contact your local solid waste management entity.

### Vermont Food Recovery Hierarchy



## The "Dirty Dozen Guide to Food Additives"

by Roddy Scheer and Doug Moss

The Environmental Working Group (EWG), a non-profit dedicated to protecting human health and the environment through research, education and advocacy, launched its "Dirty Dozen Guide to Food Additives" in November 2014 to educate consumers about which food additives are associated with health concerns, which are restricted in other countries, or which just shouldn't be in our foods to begin with. EWG hopes the new guide will help consumers avoid unhealthy foods and also influence policymakers to develop more stringent rules for food producers moving forward.

According to EWG, more than 10,000 food additives are approved for use in the U.S., despite potential health implications. Some are "direct additives" deliberately formulated into processed food; others are "indirect," that is, finding their way into food during processing, storage or packaging. Either way, some have been linked to endocrine disruption, heart disease, cancer and a wide range of other health issues.

Topping EWG's list are nitrates and nitrites, both typically added to cured meats (like bacon, salami, sausages and hot dogs) to prolong shelf-life and prevent

discoloration. "Nitrites, which can form from nitrates, react with naturally occurring components of protein called amines," reports EWG. "This reaction can form nitrosamines, which are known cancer-causing compounds." The group reports links between nitrite and nitrate consumption and cancers of the stomach, esophagus, brain and thyroid.

The World Health Organization considers nitrites and nitrates to be probable human carcinogens; California's Office of Environmental Health Hazard Assessment is now considering a similar designation. Interestingly, some nutritious foods like spinach and other leafy vegetables contain nitrates naturally, but EWG says that "human studies on nitrate intake from vegetables have found either no association with stomach cancer or a decreased risk."

Another troubling but nevertheless common food additive is potassium



That salami on your plate might look scrumptious but Environmental Working Group warns it may contain nitrates linked to cancers of the stomach, esophagus, brain and thyroid. Credit: Alpha, Flickr CC

bromate, used to strengthen bread and cracker dough and help such items rise during baking. But potassium bromate is listed as a known human carcinogen by the state of California and a possible human carcinogen by the International Agency for Research on Cancer. Animal studies have shown that regular exposure to potassium bromate can cause a variety of tumors, is toxic to the kidneys and can

even cause permanent DNA damage.

Most of the potassium bromate added to foods converts to non-carcinogenic potassium bromide during the process of baking, but small but still significant unconverted amounts can remain, putting eaters everywhere at risk. EWG would like to see the U.S. government follow the lead of Canada and the European Union in banning the use of potassium bromate in foods altogether.

Other additives on the Dirty Dozen list include propyl parabens, butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), propyl gallate, theobromine, diacetyl, phosphates and aluminum. Many artificial colors can also cause health issues, reports EWG, as can thousands of "secret flavor ingredients" that food makers add to foods without oversight in the name of protecting trade secrets. For more information on these foods and how to avoid them, check out EWG's free "Dirty Dozen Guide" online.

Contact: EWG, [www.ewg.org/research/ewg-s-dirty-dozen-guide-food-additives/food-additives-linked-health-risks](http://www.ewg.org/research/ewg-s-dirty-dozen-guide-food-additives/food-additives-linked-health-risks).

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# THE ART OF CROSS-COUNTRY SKIING

by Roger Lohr

Cross-country (X-C) skiing is a terrific way to enjoy the great outdoors in winter. The pleasures of XC skiing can take your mind off the stresses of the daily grind, whether you seek the solitude of solo skiing or are spending some quality time with family and friends. It's also a great aerobic activity, enabling you to burn up hundreds of calories per hour without straining joints such as ankles and knees. You'll get a low-impact workout while enjoying the outdoors, and the scenery sure beats the view at your local health club.

Where do you plan to ski? The terrain and location helps determine your equipment choices. X-C skiing allows you to choose from a variety of locations: parks, golf courses, hiking trails, or XC ski areas are all good choices.

You can rent equipment at your local ski shop or at the ski area. This is often recommended for first-time skiers and some ski shops will apply the price of rentals toward purchasing new equipment.

Buying used equipment at a ski swap may be a mistake. Be aware that at garage sales and some swaps, you may wind up with gear that is outdated or inappropriate for you. Buy a package deal that offers a discount when you buy skis, boots, bindings, and poles together.

In-track X-C skis are used with a traditional kick-and-glide motion on maintained track systems set by special grooming machines. They have minimal sidecut so the skis will stay in the tracks. Sidecut refers to the narrowness of the

middle part of the skis in relation to the wider tip and tail.

Off-track X-C skis are often used to navigate ungroomed trails and terrain in parks, open fields, and on golf courses. They are wider than in-track XC skis and provide more flotation and stability in fresh snow. Backcountry skis are for the more adventurous skier, who might experience variable snow conditions. They can be as wide as alpine skis, for better flotation, and feature metal edges for more control. A salesman may try to sell you steel edge skis for more control, but be aware that these skis will not glide very well on the flat terrain compared to in-track skis.

Some X-C skis have waxable bases, on which you put "kick wax" for grip. Other skis have waxless bases. A pattern in the middle third of the ski base, such as small plastic ridges or scales, provides the grip. Waxless skis have been designed to run beautifully in just about any kind of snow. Your decision will center on whether you want optimal performance by waxing or optimal convenience with waxless skis. Snow conditions will be a factor, because changing conditions require skiers on waxable skis to use different waxes. Skating skis are used with a skating-type stride on groomed trails that are wide with packed lanes. They are shorter, narrower, and lighter than traditional XC skis. The technique is similar to inline skating, except poles are also used. Skating skis allow the skier to glide faster and for a

longer distance for each stride. They can provide the ultimate fitness workout and going uphill can be a challenge.

Have the ski bindings professionally installed on the skis. Be aware that the bindings must be matched to the type of boots that you select as they come in different integrated systems.

Your boots should feel just like running shoes so try on the boots wearing the socks that you plan to wear when skiing. Consider footbeds or fitted insoles if you have problems with your feet. Because of these various sizing methods, it's important to try on boots before buying them. The fit should be snug and your heel should remain in place. You should be able to wiggle your toes.

X-C ski poles are used to help forward thrust. Skiers plant their poles behind on an angle. If this is your first set of X-C gear, any reasonably light pole will be fine. Select poles that fit comfortably under your armpits when you stand on the ground. A little longer is okay, too.

Now get going. X-C skiing is relatively easy to learn, but first-timers should take a lesson from a qualified instructor to great-



XC skiing is relatively easy to learn for the whole family. Photos courtesy of Fischer Skis.

ly enhance the experience. Call ahead to the local X-C ski area to find out about lessons and any special packages that are available. As your confidence on the skinny skis grows, you'll have a lifetime of nature outdoors, fitness and fun.

Roger Lohr is the founder and editor of [XCSkiResorts.com](http://XCSkiResorts.com) and prolific national writer on cross-country skiing.



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## LOON SNOWMAKERS Cut Electricity Use by One-Third

By Tamsin Venn

Many New England downhill ski areas are taking steps to reduce energy use. Loon Mountain is a leader in that effort in New Hampshire. In the past three years it has cut its electric bill by a third.

"The electricity savings came in with new low-energy snow guns," says Ken Mack, Loon's Snowmaking Manager. Mack has worked at Loon for 15 years, getting to know its snow and weather practically right down to the flake pattern. He is the third in his family to groom at Loon, his grandfather, father, and uncle preceding him. Now he masterminds the fluffy stuff with a crew of about 35, working 24/7.

"When I first started we used mainly internal-mix snow guns. We would move them around the mountain, it was very labor intensive," Mack says.

Each snow gun would consume anywhere between 300 to 400 cubic feet per minute (cfm) of pressurized air and 20 to 30 gallons per minute (gpm) of water.

Water sources include the East Branch of the Pemigewasset River, Connector Ponds by Clark's Trading Post, and Boil Brook.

New HKD Impulse tower snow guns use 20 to 50 gpm of water, but only 127 cfm of air, so two thirds less and then some, according to Mack.

"That first season, our electricity went down by a third. We didn't have to compress as much air. It resulted in hundreds of thousands of dollars in savings," says Mack.

"The fixed towers allow you to take advantage of smaller windows of cold temperatures. You don't have to get out there and move them around," Mack points out. "We took that to next level by purchasing the HDK click hydrants."

Those connect to the HDK guns, replacing the work where the snowmaker hooks up the hoses, and turns the gun on and off and drains it, about five minutes per snowgun.

Are there any state or federal incentives for being energy efficient?

Mack notes that Vermont and Maine have outstanding incentive programs, less so New Hampshire. (Read about Efficiency Vermont's program in "The Great Snowgun Roundup," GET, Oct. 15, 2014). NH Electric Coop does give Loon some incentives.

Loon plans to add more click hydrants for safety, quicker on and off times, and better snow surface. Of 1,400 hydrants, 150 are converted to clicks.

"It's a big investment. Every year we do a little more," says Mack.

cont'd on p.37

## Save Big On Backcountry Skis, Snowshoes & Winter Clothing

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# YOU CAN GET A CRAZY AMOUNT OF BPA FROM CASH REGISTER RECEIPTS

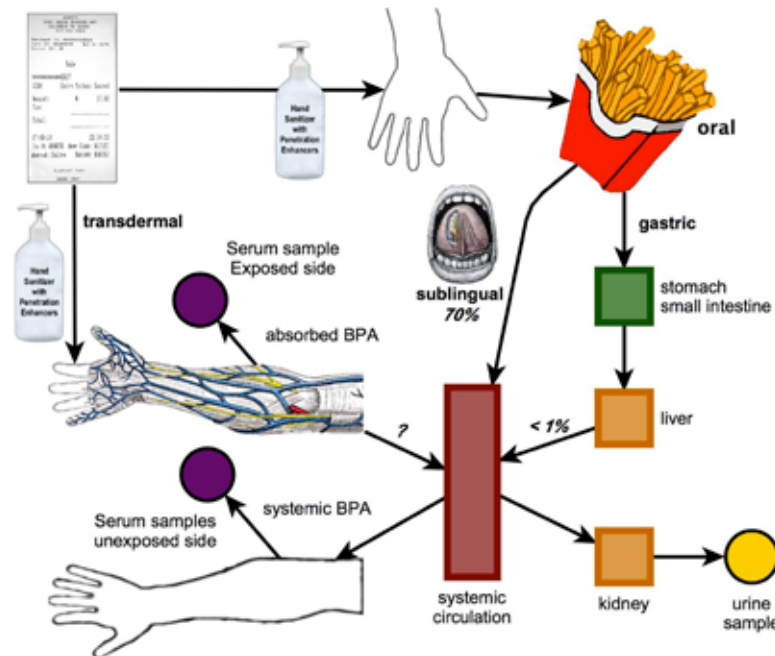
By Paul Rauber

Ever since early exposes showed the endocrine-system-disrupting effects of the industrial chemical BPA, manufacturers have discontinued its use in water bottles, baby bottles, and binkies. (That's why everyone drinks their water out of metal containers these days.) In estimating human exposure to the gender-bending chemical these days, federal regulators assume that the main source of exposure to BPA is from food and beverage packaging. However, a new study by Frederick vom Staal and others in the journal PLOS One shows that another significant point of entry could be handling of thermal receipts--those ubiquitous slips of paper that come at the end of nearly every financial transaction--especially if you have used hand sanitizer or various other skin creams. Doing so, the study found, can increase uptake of BPA a hundredfold. Worse, if you handle a BPA-coated receipt and then eat food with your hands, you ingest the BPA as well.

We found that when men and women held thermal receipt paper immediately after using a hand sanitizer with penetration enhancing chemicals, significant free BPA was transferred to their hands and then to French fries that were eaten, and the combination of dermal and oral BPA absorption led to a rapid and dramatic average maximum increase (Cmax) in unconjugated (bioactive) BPA of 0.7 ng/mL in serum and 0.20 mg total BPA/g creatinine in urine within 90 min.

The implications for the fast-food industry are pretty clear.

To assess the relevance of this research



to real-world behavior, we conducted a preliminary observational study in fast-food restaurants, food courts and shopping malls in Columbia, Missouri. Receipt contact time varied widely, but was sometimes substantial. In one restaurant, we found that receipt contact time ranged up to 65 seconds for people purchasing food that was eaten in the restaurant; the 75th percentile for time holding the receipt was .12 sec, and the 90th percentile .32 sec. In a fast-food restaurant that is part of an international chain, take-out food was placed into a bag

and the top of the bag was folded, then the thermal receipt was stapled to the top of the bag; the result was that the print surface of the receipt (coated with BPA) was grabbed when the bag was picked up. The contact time between the hand and thermal receipt was thus considerably longer than would be the case for food eaten in the restaurant. In a food court we observed that some fast-food restaurants had hand sanitizer dispensers available for use by customers next to the cash register, and customers were observed using the hand sanitizer before handling the thermal receipt. The estimate is that 50 million people eat in a fast-food establishment every day in the USA. Finally, our experiments here are also relevant to occupational exposures, because we observed in a national chain big-box store that all cash registers had a hand sanitizer dispenser next to them for use by the cashiers.

And if you're looking for investment opportunities, you might want to check out alternatives to those thermal-receipt machines. As the authors conclude:

Because no safe alternatives to the use of BPA or its primary replacement chemical

BPS in thermal paper have been identified, our findings provide support for the EPA's recommendation that thermal paper should be replaced with other safer technologies.

Finally, the study's results suggest a prudent course of action for shoppers: "Receipt?" "No thanks."

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## LOON SNOWMAKERS

cont'd from p.36

### Loon's Other Sustainable Initiatives Recycling and Waste Stream

- The base lodge recycling program lets guests recycle bottles and cans in three base lodges.
- On-mountain lodges support recycling of glass and plastic bottles.
- Washable plates and soup bowls are used in the Octagon Cafeteria, and all locations use or are switching to earth-friendly hot and cold cups and napkins.
- Cardboard
- Steel
- More than 300 gallons of waste oil and vehicle fluids each year. Loon's Maintenance Center also has a 2,800-gallon oil-water separator, which can separate oil and other waste from water before it is flushed into the septic system.
- Motion sensor activated paper towel dispensers to limit paper towel use.

### Increasing Energy Efficiency

- Recent snowmaking upgrades have included more than 650 new HKD 5V-10 impulse tower guns, which added substantial firepower to Loon's already powerful snowmaking system (See above).
- Conversion of all lighting over to compact fluorescent bulbs, which use approximately 75% less energy than incandescent bulbs
- Installation of efficient Buderus boiler upgrades, installation of efficient Marathon water heaters



New snowmaking equipment at Loon Mountain, in New Hampshire, is taking many sustainable initiatives to reduce their carbon footprint and save on electricity costs and needs.



- Motion sensors on restroom lights
- Installation of "air curtains" in the Governor's Lodge Snowsports Area and Adaptive Program to better retain heat
- New, efficient windows and doors installed in the resort's administrative offices, Children's Center, and base lodges, for heat retention
- Improving air quality
- Anti-idling policy for company vehicles
- Lodging shuttles to minimize use of individual vehicles and limit vehicle emissions

Tamsin Venn is a staff writer for AC Kayaking Magazine and Green Energy Times.

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# What's up with ... NATURAL PAINTS?

By Jessica Barber Goldblatt



source: www.matternetwork.com

We are surrounded by painted surfaces, in our homes. In conventional paint formulas, there are three basic elements which are pigment, binder and an agent to combine the pigment and binder into a liquid solution. In recent years the paint industry has responded to consumer demand for more healthful, greener products by reducing the amount of VOCs, in some of their paints. Most conventional paint manufacturers today offer low-VOC or zero-VOC versions of latex paints. However "zero-VOC" paints may still contain as much as five grams of VOCs per liter of paint -- before tinting is added. The approach of paint manufacturers has been to focus and remove certain toxins from their paint formulas that have come under fire, not to take a holistic view of the overall safety and sustainability of their products.

While the reduction of VOC's is a step in the right direction, VOCs are not the only problem with petrochemical paints. According to some sources, removing the VOCs from paints actually results in more ingredients such as fungicides, mildewcides, exempt solvents, and odor-masking agents overall as well as a more energy-intensive production process. It is virtually impossible to seriously scrutinize paint manufacturers' claims that their products are sustainable and healthy to use because they fail to fully disclose their ingredients. Some of these may include:

- **Ethylene glycol** ethers are primarily used in paints and cleaning solvents. Short term exposure to high levels of these chemicals can lead to conditions such as pulmonary edema, narcosis, as well as liver and kidney damage.
- **Formaldehyde** is used as a preservative. It is a pungent-smelling, colorless gas,

which can cause burning in the eyes and throat, nausea, and difficulty in breathing. Formaldehyde has also been demonstrated to cause cancer in animals and may cause cancer in humans.

- **Hydrochloric acid** can be a colorless liquid with a strong odor, or a colorless to slightly yellow gas. It is used in the manufacture of pigments for paints. Exposure to hydrochloric acid may lead to circulatory collapse, respiratory

illness, and a variety of other adverse effects.

- **Benzene** is commonly added to paint to help it dry more quickly. It is an aromatic, colorless substance that evaporates quickly into the air. It is highly toxic when inhaled, and known to cause cancer, leukemia, and can affect the central nervous system.

- **Toluene** is used in the production of paints, paint thinners, and lacquers. It is a sweet-smelling industrial solvent, created through petroleum refining. It is considered to be a dangerous neurotoxin, as well as a developmental toxin.

Even zero-VOC paints must be properly disposed of at your local hazardous material collection center to prevent contamination. The EPA estimates that about 10% of all paint purchased in the United States becomes leftover -- around 64 million gallons annually.

Historically, latex paint along with oil-based paint commonly contained lead and mercury. While a concerted effort has been made on many fronts to curtail the use of these toxic ingredients in paint, the best way to avoid them completely is by using non-toxic natural and solvent-free paints.

Truly natural paints are so safe that a pregnant woman could paint the nursery with the windows closed without worry. And while they are more difficult to find in stores, they're pretty easy to find online. Made from plants, minerals, milk-protein, and clay, they may offer a limited range of colors, but the natural depth and complexity of the colors are something

that cannot be achieved with synthetic pigments. Natural paints are fast and easy to clean up. Unlike oil and latex, you can safely throw them in the garbage or rinse them down the sink with soap and water. Some examples are:

- **Plant and mineral paints** are as easy to use as latex, require one to three coats and may need a primer, which is also available

as plant or mineral-based. Of all the natural options, plant and mineral paints offer the largest selection of colors and are the easiest to use.

- Milk paints are usually a mix of cow or goat's milk, lime, clay, and earth-based pigments. A naturally rustic look with slight variations in shading add to its beauty. Milk paint ages well, does not chip, and becomes more lustrous over time.

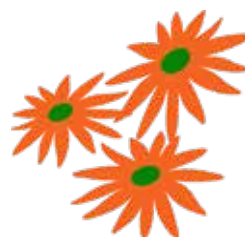
These paints are packaged as a dried powder and need to be mixed with water before use. They require

one to three coats, dry quickly so you can re-coat in just two hours.

- Clay paints offer a thicker, plaster-like finish with rich hues, are naturally mold-resistant, highly durable, and easily cover interior surfaces without need for a primer. They take one to two coats and help to regulate the temperature and humidity inside your home, staying warm to the touch in winter and cooler in summer.

Jessica Barber Goldblatt is the owner of Interiors Green -- the Home and Living Store at 2021 Main Street in Bethlehem, NH. [www.interiorsgreen.com](http://www.interiorsgreen.com).

... removing the VOCs from paints actually results in more ingredients such as fungicides, mildewcides, exempt solvents, and odor-masking agents overall ...



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# Wood: A Sustainable flooring

By Cindy Humiston Weed



Peter Nazarenko (courtesy photo).

to your health," said Peter Nazarenko, 64, the founder and co-owner of Planet Hardwood.

Peter Nazarenko and his wife, Diane Nazarenko, have been in the wood business in its many incarnations for over 40 years. Peter Nazarenko started helping flooring mills with environmental certification and developing certified flooring products back in 1993.

"Wood is inherently the most environmentally responsible building material, especially when compared to any other floor covering. Concrete, vinyl and even quarried products are environmental disasters by comparison," Peter Nazarenko said. "Wood flooring also takes less energy to produce, leaves no toxic trail, has no waste by-products, harbors no allergens, and adds value to property. It can outlast carpet, for example, by a factor of 10."

In order to bring the most spectacular woods to Planet Hardwood's customers, Peter Nazarenko has been all over the world visiting sawmills and promoting responsible forestry. The result: His showroom offers ample space for large flooring samples of ash, birch, cherry, maple, hickory, oak and walnut plus exotic woods like cork, canary wood, cuchi, curcuy, sirari, soto, haro and morado.

The company's pre-finished hardwoods comes in all three grades: "country," "natural," and "select," the grade assigned according to the number of short pieces, knots, contrasting colors and grain patterns.

"It is very important that all the wood is used," Peter Nazarenko explained.

Planet Hardwood also carries other eco- and people-friendly products for buildings like Safecoat paints, stains, coatings and cleaning products, American Clay Plaster, low-VOC mastics and finishes

for wood flooring, cork and Marmoleum. The last is a flooring material made from pressed flax seed oil, pine resin and wood flour. For the kitchen, Planet Hardwood offers bamboo counter tops and a new state-of-the-art counter top material called Richlite, made with 10,000 layers of recycled paper that are compressed under 50,000 pounds of pressure. They supply floor underlayment, floor stains and installation tools.

To support sustainable businesses, the Planet Hardwood showroom has space allotted to John Monks and his business, VT Tree Goods of Bristol, Vermont to display some of his unique recycled wood furniture. Starting with logs discarded or otherwise unusable to the commercial logging industry, Monks saws slabs in order to construct a variety of chairs, tables and benches.

"I like to support his idea for another wood-based business," Peter Nazarenko said.

For more information about health and environmental issues in the building and home improvement industry, such as preventative maintenance and the dos and don'ts of caring for wood products and flooring, the Planet Hardwood website and blog are invaluable sources.

Cindy Humiston Weed, Enosburg Falls, Vermont, is a freelance writer and photographer; owner of Jewelwood of Vermont, wooden jewelry and barrettes; owner of Weed Public Relations; and former Vermont state legislator.

Wood has been the go-to material for flooring for centuries. It's not only an attractive, durable and biodegradable natural resource, when harvested and grown in a responsible manner, it is also sustainable.

Long before "being green" was popular, Planet Hardwood in St. George, Vermont was ethically sourcing what they believed to be the most earth-friendly and health-friendly hardwood flooring available anywhere on the planet.

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Katrina P, Bridport, VT**

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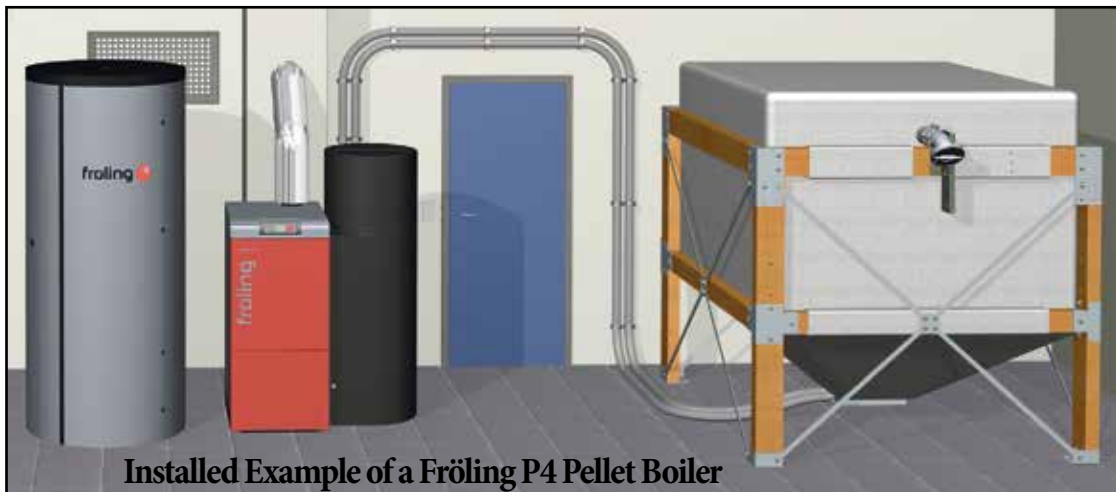


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