



Lebanon Energy Quest

Super Quest 2021: Climate Connections



This Quest is one of 12 Quests featured in this year's Super Quest challenge to reflect on ways in which climate change is affecting the Upper Valley and how our communities are addressing these changes. **Lebanon Energy Quest** highlights the many efforts to transition the City's energy to cleaner, sustainable systems that lesson their impact on climate.

This year's **Climate Connections Super Quest** examines the ways climate change is affecting the Upper Valley—from plants, insects, and other animals moving here from the south due to warming temperatures; to more frequent and more powerful storms; to people moving here from other places experiencing even greater climate-induced changes. The Super Quest also looks at ways we're preventing or adapting to climate change, including flood control through land preservation; green energy technologies; and regenerative agricultural practices.

Lebanon, New Hampshire

Physical Difficulty: Easy

Walking Conditions: Pavement

Special Features: Historical, Field Trip

Duration: 1:00

Bring: Binoculars, \$ for ice cream

To get there: This Quest begins at the Rivermill building in Lebanon, NH. From I-89, take exit 19 and take Route 4 East (Mechanic Street) towards the Historical Lebanon District. Turn in at 85 Mechanic Street, at the Rivermill Commercial Center sign and park down the hill near the left end of the building.

Clues:

The Old Days

Mascoma is supposed to be a First People's name
Who travelled this river, fished and hunted for game.
When white settlers came to this area, their quest
Was energy; water power was best.

80 mills constructed, along Mascoma River.
For 200 years, water power the giver
Of products from local resources, like flour,
And cornmeal, shingles, slate and lumber,
Furniture, leather, felt, sponges and butter.

Woolen mills ended the era, looms clacked through the night
Weaving flannel, and blankets and fabric so tight.
Sheep grazed the hillsides, not a tree was in sight.
Mascoma Flannel Mill, first in 1882, became Rivermill, you see,
Was the last woolen mill to close, in 1953.

Walk around back down a dirt ramp, there's no sign.
See the dam and grates that dropped water to a turbine,
Which once turned looms with renewable efficiency,
And now makes, 234 Kilowatts of clean electricity.
*(For comparison, Mascoma Hydro at the Powerhouse Mall
makes 1500 kW, and the Wilder Dam makes 35,600 kW.)*

Greenhouse Gases

This big mill building is one of few that survive,
Reused for offices, they keep it alive,
But heating this drafty old building's a problem.

It used to burn coal, so much pollution,
Up the yellow smokestack, puffing soot.
Now it burns propane, tanks beside the lot;
Invisible CO2 (carbon dioxide) goes into the atmosphere
Warming the planet, a climate disaster.

Continue your tour to see what Lebanon is doing
To stop all this fossil fuel spewing.

Into the Future

Drive up Mechanic Street and park by the park
Three buildings around it embarked
On a journey away from fossil fuel, so dated.

Across is City Hall just renovated
The attic was sealed so hot air convection
No longer rushes in an upward direction,
Out clock tower and opera house rafters.
New windows help reduce drafts,
Foam insulation inside cold brick walls
Stops radiant heat loss, heat usage will fall
By 53%, but that isn't all,
White roof in summer reflects the sun's rays,
An efficient chiller cools staff on hot days.

Next, on the corner, in that old Library building,
New air source heat pumps will do most heating and all cooling,
An energy recovery ventilator (ERV) so fresh air we're breathing.

The Upper Valley Music Center has entered the game.
First, air sealing and insulation saved 700 gallons of fuel,
Then they'll install heat pumps with a sophisticated name-
Variable Refrigerant Flow means one room can be cool
And another room heated, don't have to be the same.
All electric and extremely efficient.
And an ERV, or good air would be deficient.

Before leaving the park look up at the lights;
Cut off fixtures direct light sideways, not up into the night.
Lebanon will change 775 streetlights to LEDs that are smart
And dimmable. They'll use less than half the power at the start.

Look around, no solar panels do you see.
But Lebanon City gets significant electricity from PV
Panels on buildings at the solid waste facility,
Wastewater treatment plant, public works maintenance garage, and
Kilton Library.

And in 2022 Lebanon Community Power will start
Offering residents options to buy a part
Of their electricity that's renewable, up to 100%
To help the environment with money that's spent.

Exit the park by the music pavilion
Cross the intersection, out Bank St. to number eleven
A huge hand upraised seeks inspiration
Your energy quest is near culmination.

AVA is a thriving art center and gallery
Once named H.W. Carter & Sons overall factory.
A stellar example of sustainable design,
For which it was given a gold LEED sign.

In 2008 the old building was updated;
Air sealing and 141 new windows, drafts abated.
Sunshades on the South side, needs no air conditioning,
With computerized controls on heat and ERV ventilation
And a high efficiency boiler (still fossil fuel)
It uses 71.5% less energy than would a new commercial building (as a
general rule).

Go into the lobby, straight ahead in the hall,
You'll see an old sewing machine on show,
And actual overalls hang from the wall.
Down the hall to the end's where you will go.
Look out the window at the green roof below.
Then right, down the stairwell to the exit, but that's not all.

The new studio building, at left below, is a hero;
Making more energy than it uses, it's Net Zero.
104 solar panels also power the gallery behind you.
Heavily insulated below the slab, and the roof above,
Concrete walls sandwich a foam core, insulation to love.
Easily heated by heat pumps, air source,
With heat recovery ventilation, of course.
Windows are triple glazed, when sunlight comes in,
LED lights automatically do dim.

Turn right and enter the garden with sculptures.
Behind the stone bench is the end point you treasure.
Sign your name, we're so glad you came.
We hope you're inspired by what you have seen,
Yourself to save energy. Keep the planet green!

GLOSSARY

Greenhouse Gas

Gasses added to the atmosphere, mostly CO₂ from burning carbon compounds such as oil or propane, or even wood, trap the heat from the sun like the walls of a greenhouse. The temperature at the surface of the earth is warming proportionally to the amount of these gasses in the atmosphere. The polar ice caps and glaciers everywhere are melting and the sea level is rising. Catastrophic climate events are increasing as winds pick up more energy over warmer waters. Environmentalists hope to slow the warming effect by burning less fossil fuel for heat. More energy efficient buildings use less heat. Very air tight and well insulated buildings can be heated with no greenhouse gas at all, by electricity generated renewably by wind and solar.

Fossil Fuel

Carbon that has been stored in the earth for eons in the form of coal or oil, propane or methane and is extracted and refined and distributed. Most heating of buildings, most transportation and most generation of electricity depends on burning fossil fuel. Carbon combines with oxygen and forms CO₂, the major greenhouse gas.

Convection

Heated air rises and escapes, mostly through holes in the ceiling, pulling cold outside air in to replace it through holes in the basement or walls. This air movement is the biggest source of heat loss. Air sealing prevents convection heat loss.

Radiation

Heat escapes by heating up the walls and window panes. They in turn radiate heat to the outside. The "R" value of a material measures the inverse of how easily its molecules speed up and transfer heat across its substance. A low "R" value, of one or two, like a single window pane, means that the substance provides almost no barrier to radiation. A high value, like R27 per inch of foam insulation, indicates a good barrier to radiation.

ERV

Energy recovery ventilation. Very air tight buildings need a source of fresh air for people to breath. A heat recovery system pulls stale warm air into ducts and runs it through a box with narrow vanes separating it from

cooler outside fresh air pulled the other way and distributed through ducts. Some of the heat of the exhaust air passes (is recovered) to the intake air.

Heat Pump

Usually this refers to air source heat pumps. Boxes outside “grab” heat out of the outside air and transport this heat inside through narrow tubes to release it. Run in reverse they provide air conditioning by “grabbing” heat out of the inside air and releasing it outside. Heat pumps work just like a refrigerator does, by cycles of compression and release.

Compressing refrigerant squeezes the molecules and makes it harder for them to hold heat, which they do by moving around more. Compressing refrigerant makes it give off heat. When the compressed refrigerant is pumped to the other side of the wall and allowed to expand it sucks up heat from its surroundings. Pumped back inside and compressed it releases this heat to the inside surroundings. Very efficient heat pumps can extract heat from outside air down to zero degrees Fahrenheit. Because the electricity just runs pumps, heat pumps are extremely efficient, up to 3 times as efficient as a propane boiler.

Variable Refrigerant Flow

Heat pumps which can control circulation so as to heat one room (which might have bigger windows, for instance), while at the same time cooling an adjacent room which might have a meeting with lots of people in it.

LED

Light emitting diodes give off the same amount of light for a fraction of the electricity used by lights which work by heating up a filament. LEDs have been developed in many shapes to replace most old style light bulbs. LEDs can be purchased at different light brightness, varying from very white to softer and more yellow. Dimmable LED streetlights can be programmed to use less electricity when there is little traffic, for even more savings.

LEED Certification - Leadership in Energy and Environmental Design. Organized by the U.S. Green Building Council (USGBC), the LEED system rates buildings in their construction, maintenance and operations, in the areas of human and environmental health, sustainability of site development, water savings, energy efficiency, materials selection and indoor environmental quality. There are different LEED levels, such as Platinum, Gold and Silver.

Green Roof

Vegetation on a roof catches sun and rain, making oxygen from CO2 and providing habitat for insects and birds.

Solar Panels

Photovoltaic panels make electricity from sunlight. This is called renewable electricity because it is produced without contributing to greenhouse gases.

Created in 2012 and updated in 2021 by a member of the Lebanon Energy Advisory Committee, Jon Chaffee, and community member, Pat McGovern.

