Are your home energy bills breaking your bank account??

What to do??

Peter Talmage  P.E
Everyone uses electricity at home.

Electricity is the universal energy form that can do everything and can replace other energy sources.

Our local electricity provider is Eversource.
Our cars run on gasoline.

The unit of gasoline we buy is the gallon.

The unit of electricity we buy is the kilo Watt hour or kWh.
What is a kilo Watt hour? (kWh)

\[
\text{(Wattage} \times \text{time in hours}) \div 1000 = \text{kWh}
\]

A 1000 watt toaster running for 1 hr will use 1 kWh of electricity.

A 10 watt LED light bulb running for 10 hours uses only 1/10 of a kWh.
Each month we receive a bill from Eversource.

It’s based on the electricity we’ve consumed.
**Eversource**

Account Number: 0710 000 0000

### Delivery Services Detail
- Distribution Rate: 001
- Transmission Chrg: 313.00 kWh x 0.026550 = $8.31
- Distr Cust Srvc Chrg: 313.00 kWh x 0.033260 = $10.41
- Distr Chrg per kWh: 313.00 kWh x 0.000410 = -0.13
- CTA Chrg per kWh: 313.00 kWh x 0.001690 = $0.53
- FMCC Delivery Chrg: 313.00 kWh x 0.001690 = $0.53
- Comb Public Benefit Chrg*: 313.00 kWh x 0.010390 = $3.25

**Subtotal**

$41.62

### Supplier Services

### Generation Detail
- Standard Service
- Generation Srvc Chrg**: 313.000 kWh x 0.082280 = $25.75

**Subtotal**

$25.75

### Total Cost of Electricity

$67.37
Bills sometime show a summary of your monthly consumption:

With this info you can figure your average monthly consumption.
You can reduce your gasoline purchases by walking, riding a bike or getting a more efficient car.

You can reduce your electricity purchases from Evesource and your carbon footprint by generating your own electricity with a Photovoltaic array.
In MASS we have net metering:

If you generate electricity it will off set any electricity you consume from Eversource at the same rate you buy it.

Any excess electricity you generate is credited to your account at the same rate.
This credit will offset the electricity that heats our house in winter.
How large an array is needed to fully offset your consumption?

In New England (at a good solar site) a 1000 watt array will generate an average of 100 kWh per month.

If your average monthly consumption is 350kWh then the array size would be: 3.5 x 1000 = 3,500 watts.

How much would a 3,500 watt array cost?

Today systems cost about $4 per watt so: $14,000.
OUCH !! $14,000 is a lot of cash. How can you lower the cost?

1. Make use of the 30% Fed and 15% MASS tax credits

2. Make use of the MASS CEC low interest loan program

3. Reduce the size of the array by reducing your consumption

It’s a lot less expensive to save a kWh than it is to produce a kWr with solar
Now let's face up to some facts:

The Earth is warming primarily due to increasing levels of CO2 in the atmosphere.

We are on track to have average temperatures 10 F +

Can everyone think “End of life on Earth?”

We must stop burning fuels NOW!!

We must start reducing our energy consumption dramatically.

All energy must start coming from solar sources.

A super efficient homes powered by the sun must be part of the future.

Electric vehicles can provide clean transportation and can power buildings when the sun is not shining.
Were does the energy in the average New England home go?

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>59%</td>
<td>House heating</td>
</tr>
<tr>
<td>16%</td>
<td>Water heating</td>
</tr>
<tr>
<td>3%</td>
<td>Cooling</td>
</tr>
<tr>
<td>5%</td>
<td>Refrigerator</td>
</tr>
<tr>
<td>5%</td>
<td>Lights</td>
</tr>
<tr>
<td>4%</td>
<td>Kitchen appliances</td>
</tr>
<tr>
<td>4%</td>
<td>Computers and entertainment</td>
</tr>
<tr>
<td>4%</td>
<td>Laundry and others</td>
</tr>
</tbody>
</table>
Saving Energy

how's your home energy I.Q.?
Why reduce your electrical usage??

The lower your use, the smaller and less costly solar array you need

If your usage is low enough you can be an independent house when the electrical grid fails during higher temperatures in the coming decades
Had an energy audit of your house yet??

This is step number one in reducing your energy consumption

http://goo.gl/R8cfP8

http://tinyurl.com/ltdszgv

Mass Save
How much of the heat loss in a typical house is due to air leakage?
The air leakage in a house can be measured by doing a blower door test during an energy audit.

Air sealing the attic floor and basement is most important.
Other benefits of air sealing:

1. Can reduce bugs in the house (How do all those Lady Bugs get in ??)
2. Reduced air pollution coming in
3. Reduces rain leakage into the house
4. Increases fire safety
Houses that get really tight need ventilation:

Heat Recovery Ventilator

- Insulated cabinet
- Electronic control
- High efficiency heat exchanger core
- Washable filters
- High efficiency fans
- Stale house air out
- Warmed outside air in
- Electronic control
How much can you reduce your heating load by setting back the thermostat 10 degrees each night?
An automatic set back thermostat will do this for you

You'll get one for free with your energy audit!!

10%
A super insulated house uses how much less energy to heat than a conventional house?
On average 50%

All Existing homes can be upgraded to super insulation levels.
A second wall can be built inside the existing wall for more insulation.
Insulation can be added to the outside of a home.
Cellulose insulation can easily be put in walls and can be added to attics.
Insulating the top 2 feet of a basement wall can reduce the heating load of a typical New England home by how much?
By up to 20%

A thermal cameras can “see” heat. The hottest part of this house is the basement wall.
How much heating goes out the windows?
up to 25% in New England on average

Don’t get fooled into thinking all new windows will save you lots of energy.

Even great new windows still lose energy.
How much heating does a typical house receive from the sun through its east, south and west facing windows?
Remember to remove your screens to get the full effect.
Two layer plastic window inserts placed in a typical window will reduce the energy loss by how much?
Up to 50%

The inside layer is much warmer than the glass making everyone feel warmer without turning up the thermostat.
How much more heat can an air source mini split heat pump produce than a baseboard electric heater with the same amount of electricity?
Up to 300% more (C.O.P. of 3)

If you have a photovoltaic system your heating is totally green
Replacing an old refrigerator or freezer with a new energy star model will save how much electricity per year?
hundreds of kWh of electricity each year

They are quieter and are more durable as well

Utilities may offer rebates on energy star refrigerators.
When buying appliances always look for this label.

Energy Star appliances use less energy, run quieter and last longer.

These labels allow you to compare appliances
Drying a load of clothes on a line saves you how much?
About 5 kWh with a value of $.80

Your clothes will smell so much better too!
An average family can get how much of its hot water needs from the sun?
Solar water heating can also be more easily achieved using an electric water heater and a photovoltaic array.

If power fails however this system won't heat your water.

For more efficiency the electric water heater can be a heat pump model.
That TV cable box you've turn off with the remote control is still consuming how much power?
29 watts

This is called a phantom load. It does nothing

Turn these loads fully off by unplugging them or with a power strip. (You'll get one with your energy audit)
Replacing a 60 watt incandescent bulb with a 10 watt LED run 4 hours per day will save how much electricity in a year?
73 kWh

Power used by incandescent:

\[ 60 \text{ w} \times 4 \text{ hr/day} \times 365 \text{ day/yr} \div 1000 \text{ w/kWh} = 88 \text{ kWh/yr} \]

Power used by LED:

\[ 10 \text{ w} \times 4 \text{ hr/day} \times 365 \text{ day/yr} \div 1000 \text{ w/kWh} = 15 \text{ kWh/yr} \]

Energy saved: \[ 88 - 15 = 73 \text{ kWr} \]
A $15 insulation wrap added to an electric water heater can save a typical family how much electricity?
225 kWh of electricity
Phantom Loads are those loads that occur even when a device is turned “off”

How much of the electricity consumed by American consumers is phantom?
A simple meter can be used to measure the phantom load of a device.

The same device can be used to measure the energy use over time of an appliance.