Energy Master Plan for Glenside House
Prepared by Grahame E. Maisey, P.E. November 2010

Introduction

The goal of the Transition movement is to develop neighborhoods into energy independent communities. As such, we want to develop each property to its maximum potential while costing the minimum to achieve the goals. This means that this energy plan will show how to develop this house toward an independent energy future, not just reduce the energy bills by 20 to 40%. The long-term plan will eliminate the home energy bills all together and eventually generate electricity to help power vehicles to totally eliminate fossil fuel consumption.

Energy audits and reports develop items and projects that can be achieved today that will give the homeowner a modest reduction in their energy use, 20% to 40%. The problem however, is that the auditor is not an expert. They are individuals who took a one week course and now can follow the simple learned steps to prepare a short term checklist. Many of the steps they recommend will only help homeowners in the short term but many will hurt the homeowner in the long term. As technology advances and incentives change, many of these recommended projects will have to be ripped out and replaced, causing homeowners to spend more money than if they had prepared a comprehensive energy plan.

As an example of an energy auditor's poor advice, the Glenside house would benefit immediately from insulation in the external walls. As an energy expert, I do not recommend that the homeowners install it just yet. Insulation and vapor barrier technology is currently developing rapidly so that in just a couple of years the homeowner will be able to have installed insulation integrated with a vapor barrier, which this home needs to control the air and moisture infiltration. If insulation is blown in now, then later, they will have to pay to have the walls ripped open, this insulation removed and the new insulation and vapor barrier put in place and then the wall repaired. This is a much costlier fix, even while the owners pay for the extra energy now.

The above is simply one example of how long-term energy advice will differ from an energy auditor's immediate projects. Experts can prepare a long-term plan with none of the false starts or deadends that cost the homeowner more money over the long term.

As an energy consultant for over 40 years on mostly commercial, institutional and industrial buildings, I have reviewed the Glenside House and prepared a prudent, long term plan that will lead the house to become an energy generator rather than an energy user.

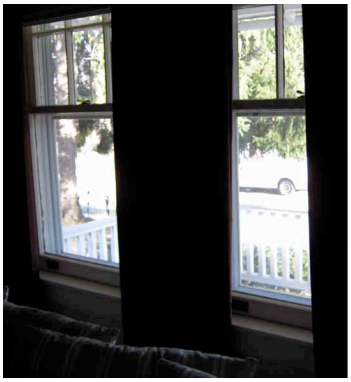
Current Status

This is a well-built house from the 1920's and could stand for another 200 years. The owners are frugal with energy use and do not have central air conditioning or window air conditioners for summer use. The thermostat is kept low during the winter heating months and there is a relatively efficient gas furnace providing warm air. The hot water heater is quite efficient and the lighting is mostly compact fluorescent.

This house offers little in the way of low hanging fruit to develop easy energy reduction projects. However, we will offer several initial steps and advice to begin on the path to climate neutrality.

Recommendations – Short-Term

A good first step is to have an air blower test to check the air tightness of the house and define where the major air leakage is occurring. Once the air blower test reveals the major sources of leaks, a program to minimize these leaks can be followed.



Passive Projects:

Windows:

- Place solar film on storm windows – this will reduce the solar gains and heat losses. Install new storm windows when much higher performing windows become available. The first double-glazed storm window has recently been offered in the commercial market. This is a sign that within 3 years there might be an optimum window upgrade available.
- The existing double hung windows will outlast any new windows by 200 years but they require rehabbing and insulation in the outer frames.

Weep holes need to be checked to ensure that they are working.

Doors and Windows:

- Weather stripping is required to be checked on all doors and windows.
- Entrance vestibules reduce cold or warm air entering when the doors are opened. Adding front and rear vestibules could be a small project.

General:

- Fill in any obvious cracks, openings, etc, including electrical outlets that should be sealed before the blower test. The blower test often reveals unknown and hidden air leaks.

Active Projects:

- Wrap the hot water heater.
- Rainwater collection can be practiced now if allowed by code and used for irrigation.
- Seal the ductwork in basement.
- Close off register on outside wall. If it's not helping to heat the room, eliminate.

These steps should help reduce energy use both winter and summer (if air conditioning is used) and at least make the house more comfortable for less money.

Recommendations – Medium and Long-Term

Future Steps to take as the cost becomes feasible or incentives allow:

Passive Projects:

- Replace storm windows at some time with good double glazed storm windows.
- South side of buildings should have deciduous trees and preferably trees that allow the roof to have solar during the summer, not tall enough to obstruct solar access during the summer.
- Insulate the walls when the technology has developed to increase the insulation to R40 and guarantee vapor and air barrier life cycle performance.
- Increase roof insulation in attic in the future to R60.
- Weatherstripping on doors and windows. Continually check integrity.
- Doors – install better performing double glazed storm doors in 3 to 5 years. Vestibules will be better.
- Small windows – replace with R15 windows in 2 to 5 years.
- Insulate basement walls either outside or inside with R45, be particularly careful of moisture and vapor transport.

Active Systems:

- Existing furnace will be oversized when insulation and windows are upgraded.
- A new air system, 15% to 25% of current size of the air, with a liquid desiccant system to control the humidity and provide 100% outside ventilation air in an airtight residence.
- Future heating and cooling should come from newly installed radiant ceilings. Most of the heat can come from solar on the Southwest roof and Southeast porch roof.
- All the cooling and preheating can come from geothermal heat exchange wells in the back yard.
- Two wind turbines in the backyard will provide 4KW of electricity.
- The roof solar will be 50% thermal and 50% solar Photovoltaic to provide heating for hot water and heating, and desiccant dehumidification.
- Solar PV will be 3KW.
- All lights should go to LED fixtures and fittings.
- Eventually kitchen systems will be moved to thermal and gas systems rather than electrical systems. The gas may be supplied by an individual or communal biodigester. High temperature solar thermal will provide boiling water.

The total electrical power generating capacity exceeds the house operating requirements. Moving to geothermal cooling and warming will eliminate any peak electrical or gas requirement while allowing the house to sell electricity during peak demand periods. The excess electricity will be used to charge electric vehicles overnight while further excess is sold to repay food and other energy use.

Conclusion

This house can become more comfortable while at the same time moving from an energy user to an energy generator.

The passive projects should be accomplished first as these will affect the active systems' projects and they should also last for 100 years when performed correctly.

The active systems will be installed when the economics of energy cost increases and installed cost decreases achieve the required payback time of the owner, usually 3 to 7 years.

Moving from a warm air furnace to radiant ceilings and a small desiccant air system is a paradigm shift in warming and cooling technology that will herald a new age in comfort, energy efficiency and longevity of thermal comfort systems. The radiant ceilings are reported to have a current life expectancy of 100 years and the desiccant systems should be developed into residential units with a long life expectancy.

The renewable energy systems, geothermal heat exchange, solar thermal and solar photovoltaic, and wind energy systems will also become less expensive to install and more efficient to operate with the advances of technology. Electric vehicles will be the transport of the future.