November 19, 2010

Elaine Brousseau
PO Box 34
Hartland 4 Corners, VT 05049

Elaine,

Thank you for arranging the energy assessment of The First Congregational Church of Hartland; and, a special thanks to the other members of the congregation involved with the "tour". The more people who are aware of opportunities for energy efficiency, the more support there will be to make the necessary investments. I hope the attached report, which is a summary of my recommendations for energy efficiency opportunities at the church will be helpful in your efforts to reduce your energy use.

Please understand that the scope of this audit service and the attached recommendations are limited and that Vermont Interfaith Power and Light (VTIPL) cannot be responsible for the condition of your building or actions taken, or not taken, by you or by other persons as a result of these recommendations. This report is not an engineering-type of assessment and it does not include estimates of costs or savings; rather, it's a description of the opportunities that the church has for reducing its energy use. I've tried to prioritize these opportunities by their relative costs and their potential savings.

I've also enclosed an informational flyer and a congregational membership form for Vermont Interfaith Power and Light (VTIPL). VTIPL is working with Vermont faith communities to raise awareness and actions around climate change. If you and/or some of the members of your church are interested in learning more about energy efficiency, climate change and what can be done in homes and/or as a faith community, I encourage you to contact VTIPL (www.vtipl.org, 1-802-658-0902) and to become members. Also, if you feel that this audit service has been of value to you and/or your church, I encourage you to make a financial contribution to VTIPL. Your support will enable us to continue to offer this service to other Vermont faith communities.

I hope this information is useful to you and your work at the church. If you have any questions or need additional information, please contact me.

Sincerely,

Ron McGarvey
VT Interfaith Power and Light
802-865-4424
RMCGAR864@aol.com

Review of Energy Use
for
First Congregational Church, Hartland, VT

Fuel Oil

Building	Jul 2006-Jun 2007	Jul 2007-Jun 2008	Jul 2008-Jun 2009	Jul 2009-Jun 2010
Church	1,387	1,494		1,244

The table above shows the fuel oil delivered to the church during past heating seasons. Deliveries don't correspond exactly to actual usage, but given similar delivery dates over several years the gallons delivered provide a good estimate of usage and enable you to make year-to-year comparisons.

Based on the table above, heating energy use at the church has been fairly consistent over the past 3-4 years. This suggests that use of the heating system and thermostats setting have been consistent over this period. You would expect to see variation of +/- 10% per year in heating energy use, and greater variation when winter weather is extremely cold or unusually warm.

It is recommended that you continue to compile fuel oil use on an annual heating season basis (July-June) and use these year-to-year comparisons to identify trends, changes in building use that impact energy use, and as a way to evaluate the effectiveness of your energy efficiency efforts.

To monitor your fuel oil use and to separate the effects of changing weather, it is recommended that you calculate the gallons of oil used per Heating Degree Day. Heating Degree Days measure the relative coldness of the winter, so by comparing fuel oil used per Heating Degree Day for different winters you can account for different winter conditions and monitor the effectiveness of your energy efficiency efforts. To do this you need to compile records of fuel oil deliveries on an annual basis, July-June; obtain Heating Degree Data from the National Weather Service and calculate the gallons of fuel oil used per Heating Degree Day.

Electricity

CHURCH

Usage	2004	2005	2006	2007	2008	2009	Jan-Aug 2010
Annual Kilowatt Hour (kwh)	4,886	3,850	6,075	6,207	6,143	7,260	
Monthly Average KWH	407	321	506	517	512	605	913
Month with Highest KWH Usage	Jan (949)	Dec (572)	Feb (844)	Feb (924)	Feb (1051)	Mar (1487)	May (1579)

The above table and the attached graph show the electricity usage at the church for the past six plus (6+) years. The trend over this period has been one of gradually increasing electricity use

with significant increases during 2009 and 2010. I'm not aware of new or additional electrical equipment being installed during that period, so the assumption is that the increased electricity use is due to increased use of the building, i.e. more meetings, events, etc.

There are some seasonal patterns to the usage, i.e. higher use during the winter months when there is a greater need for lights and heating system operation. There is also a consistent peak in usage during February and March (2006-2009), which is probably related to increased activity and/or meetings during this period. Usage during 2010 shows a change from previous years in that there is high usage during May-June. Again, this is assumed to be the result of increased use of the building during that period. Given your familiarity with how the building has been used, I'm assuming that you may be able to identify the factors affecting this reduced usage.

To help monitor electricity usage it is recommended that when the monthly electric bill is received that you record the kilowatt hours (kwh) used and calculate the value of "kwh/day". Monitoring these values and comparing them on a month-to-month basis is a way to identify activities that impact usage and is a way to monitor usage and the impacts of your energy efficiency efforts.

PARSONAGE

Usage	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**Jan-Aug 2010**
Annual Kilowatt Hour (kwh)	7,138	5,639	8,767	9,124	9,840	5,598	
Monthly Average KWH	595	470	731	760	820	467	19
Month with Highest KWH Usage	Jan (947)	Jul (756)	Jan (886)	Dec (990)	Jan (1078)	Apr (1215)	

Although my walk-thru did not involve the parsonage, the electrical usage data provided by Efficiency Vermont included usage data for the parsonage, so I've included that data in the table above and the attached graph. The pattern of electricity usage at the parsonage is irregular and it appears that since the summer of 2009, the parsonage has not been occupied.

Carbon Footprint (pounds of CO2/year)

The table below is an estimate of the combined greenhouse gas emissions (pounds of carbon dioxide, CO2) generated by your church. For a more comprehensive estimate of your congregation's carbon footprint go to www.coolcongregations.com. By taking action on the opportunities for energy efficiency identified in the following section, you can reduce the impact of climate change and show your stewardship of our earth.

CHURCH

Material	Quantity	Pounds of CO2 per…	Total Pounds of CO2/Year
Fuel Oil	1244	22.4 lb CO2/gallon	27,900
Electricity	7260	1.2 lb CO2/kwh	8,700
Propane		12.7 lb CO2/gallon	
Trash		2 lb CO2 per gallon	
Gasoline		19.6 lb CO2/gallon	

The largest contributors to Vermont's greenhouse emissions are our cars and trucks. Not included in the table as a significant source are the pounds of CO2 emitted from the cars and trucks that you and members use to drive to church services and activities. EXAMPLE: 50 cars driving 5 miles per week to church generate about 13,000 lb. of CO2. Car-pooling and ride sharing for church activities can significantly reduce your greenhouse gas emissions. Contact Vermont Interfaith Power and Light (www.vtipl.org) if you would like more information or assistance in reducing your church's greenhouse gas emissions

Energy Efficiency Recommendations for First Congregational Church, Hartland, VT

The following recommendations for energy efficiency are based on a walk-thru assessment done on October 30, 2010. The scope of this energy assessment service and the following recommendations are limited. Vermont Interfaith Power and Light (VTIPL) cannot be responsible for the condition of these buildings and their equipment, or actions taken, or not taken, as a result of these recommendations.

Overview: There are four (4) general aspects to energy use in all buildings, including churches.

- The thermal resistance of the building envelope, i.e. level of insulation in the walls, ceiling, windows, etc. The thermal resistance of the church is low due to the minimal attic insulation, i.e. 6 inches
- Air leakage, i.e. the loss of heated air and the infiltration of cold air. There are always cost-effective opportunities to reduce air leakage.
- The efficiency of the equipment, i.e. heating, lighting, refrigeration. Higher efficiency equipment is available for all applications.

- The behavior of the occupants, i.e. thermostat settings, open/closed doors-windows, etc. Thermostats are being setback, but greater thermostat setbacks can save energy at no costs.

#1 Reduce Air Leaks: Warm (heated) air that leaks from your buildings costs you money twice. First, the money you spend to heat it, and second, the money that you have to spend to heat up the cold outside air that replaces it. Reducing air leaks in the areas identified below is relatively inexpensive to do, and will be a good start to reducing your heating energy costs.

- Exterior cracks and openings: Tuckpoint foundation cracks and caulk exterior cracks/openings where air can leak in/out of the building.

There are no obvious cracks or openings in the above ground foundation that need to be filled.

- Windows: Ensure that all storm windows are in place and fit tightly; caulk the exterior edges of window frames and the interior trim to minimize airflows.

Most of the windows have storms or are double-glazed. There is one stained glass window at the front of the church that does not have a storm or exterior covering. Not all of the existing storms are in place for the heating season. You should specify a date in November for "winterizing" the building, e.g. all storms in place, exterior doors weatherstripped, etc.
There are large gaps between the exterior wooden window frames and the brick walls of the sanctuary portion of the church. These gaps should be filled/caulked to reduce both airflows and water penetration.

- Exterior Doors: Make sure that doors to the outside close tightly and install weatherstripping and door sweeps to eliminate any "light gaps" that are visible from the inside when the door is closed.

The front doors to the church have door sweeps, but there are still "light gaps" at the sides and bottoms of both front doors. The side door at the far end of the annex does not close tightly. Since this door is used a lot you should ensure that it closes tightly.

- Interior Doors to Unheated Spaces: Make sure that these doors close tightly, are kept closed and that they do not have "light gaps". Consider installing weatherstripping and possibly insulation on the "cold side" of these doors.

The door from the sanctuary to the annex should be weatherstripped and kept closed during the heating season. Also, the doors to the basement/kitchen-dining room should be weatherstripped to close tightly and kept closed during the heating season. The door to the stairwell beside the Pastor's office should also be weatherstripped and kept closed.

- Ceiling Vents/Openings: In winter, seal or cover ceiling vents that are used for ventilation

Not Applicable

- Attic Access: Ensure that the access door/opening to the attic closes tightly and has weatherstripping and insulation on the "cold side".

The access panel to the attic area above the sanctuary should be weatherstripped to close tightly and it should be insulated on the "cold side".
The access panel to the attic area area of the annex has some insulation on the "cold side", but it should also be weatherstripped to close tightly.

- Fireplace: A fire in an open fireplace generally results in a net loss of heating energy due to airflow up the chimney. Ensure that the fireplace damper closes tightly. Consider sealing the fireplace opening to prevent its use or using an airtight wood/pellet stove insert instead of an open fireplace.

Not Applicable

- Kitchen Range/Oven Hood: Make sure that air doesn't leak through the range hood or ventilation fan when the range/oven are not in use

If people experience cold air drafts from the range hood above the stove, make sure that the hood dampers close tightly when the range is not in use.

- Other Locations/Openings:

The entry foyer and the storage closet in the balcony have circular metal plates in the ceiling that suggest that there used to be a stove pipe or some heating equipment flue pipe in those areas. Make sure that these metal plates are sealed tightly to prevent the loss of heated air due to "stack effect."

Consider installing a door at the end of the annex hallway near the side entrance and the stairway to the basement. The annex has two heating zones that are usually maintained at different temperatures, but without a door at the top of the stairway that is a constant flow of air, and heat, between the two zones.

Keep the sliding doors in the balcony closed during the heating season.

#2 Control Thermostats: Reducing thermostat settings when rooms/spaces are not occupied is the single most cost-effective action you can take. If you are able to reduce the thermostat setting in an unoccupied space by 10F for eight hours per day throughout the heating season, you will reduce your annual heating costs for that space by 10%.

- Reduce the heating thermostat setting in offices, meeting rooms, classrooms and other occupied spaces to 68F

- Setback the heating thermostat setting to 50F when spaces are not occupied.

Setting back thermostats throughout the church when spaces are not occupied is the easiest and most cost-effective measure that available.
It was reported that the thermostat in the sanctuary is OFF except for Sunday services. This is an excellent practice that should be continued.
It was reported that the thermostat for the first floor of the annex is setback to 60F when the space is not occupied. This is a good practice and a greater setback to 50F when unoccupied would reduce heating energy use for this space by 5-10%.

Continue to setback the thermostat in the basement/dining room area when that space is not occupied.

- Turn off the air conditioning or set the cooling thermostat up to 99F when spaces are not occupied

Not Applicable

- Install programmable thermostats to ensure consistent temperature setbacks and to automate the warm up of spaces prior to being occupied

Programmable thermostats are in place.

- Check the temperature of hot water at the faucet to ensure that hot water at the faucet is not hotter than 120F. Reduce the water heater thermostat setting, if necessary.

- Other temperature controls

Consider relocating the thermostat from the first floor hallway of the annex to the pastor's office or the meeting room at the end of the annex. In it's current location the thermostat is responding to airflows in the hallway, which can lead to overheating of the individual rooms. Try to locate the thermostat closer to the rooms that are occupied and used the most.

#3 Install Energy Efficient Lighting: Installing compact fluorescent lamps (CFL's), LED bulbs and T-8 tube fluorescents with electronic ballasts will significantly reduce your electricity use for lighting. The longer life of these lights will also reduce your need to purchase replacement bulbs and the cost and time of labor to replace burned out bulbs.

- All EXIT signs illuminated by incandescent or fluorescent bulbs should be retrofitted with LED bulbs or replaced with LED versions that use 1-2 watts and last for 50,000 hours.

- Replace all incandescent bulbs that are ON for 1 hour or longer per day with CFL's, which will use 70% less electricity and will last 6-8 times longer. **NOTE:** Check on the availability of price discounts through Efficiency Vermont to reduce the purchase price of CFL's

- Stop purchasing replacement incandescent bulbs. Establish a policy of purchasing CFL's to replace any incandescent bulbs that burn out.
  NOTE: Contact Efficiency Vermont, www.efficiencyvermont.com, to help locate replacement CFL's.

The candelabra-type bulbs in the chandeliers of the sanctuary can be replaced with CFL's; however, it's not certain that these types of CFL's are yet available as dimmables

.

- Replace T-12 tubular fluorescent lamps with smaller diameter T-8 lamps and electronic ballasts that will reduce electricity use for lighting by 50% while providing the same level of lighting. **NOTE:** Check on the availability of rebates from Efficiency Vermont for the purchase of T-8 lamps and electronic ballasts.

T-8's have been installed in the annex hallway and there may be additional locations where they can replace T-12's.

- Install a timer to control the hours that outside lights are ON and adjust the timer at least two (2) times per year to accommodate the changing number of daylight hours.

A timer is used for the outside light, but it's not clear that it is adjusted for the changing number of daylight hours.

- Install occupancy sensors in rooms (bathrooms), hallways and spaces where people forget to turn lights OFF

- Investigate the potential to replace high-wattage, recessed halogen lights with lower wattage fluorescent lamps. Contact Efficiency Vermont for technical assistance in selecting replacement lamps.

Not Applicable

- Other lighting opportunities

. It was reported that CFL's had been installed in the ceiling fixtures of the dining room, but that the light from the CFL's caused the roast beef dinners to have an "orange" color, so the incandescent bulbs were re-installed.

I asked Gabe Arnold, who is the lighting expert at Efficiency Vermont if he had a recommendation for this problem. He suggested that CFL's that are labeled to have a Color Temperature of 2700K and a Color Rendering Index (CRI) of 80 or higher should provide light that is very similar to that provided by incandescents. You should try a few of these types of CFL's to see if the color of the roast beef is acceptable
Gabe also said that the newer LED lights provide broad spectrum light similar to incandescents and that lower cost LED lights will be available in the future.

#4 TURN OFF:

- Office computers and the copier when the office is not occupied

- Electric space heaters

- Lights when not needed

- Dehumidifier. Identify the source(s) of moisture and eliminate or reduce moisture in the space rather than operating a dehumidifier

- Refrigerator and/or freezer that are almost empty or seldom used. Combine the contents of multiple refrigerators and/or freezers and turn empty units OFF. Efficiency Vermont (1-888-921-5990, www.efficiencyvermont.com) has a free meter loan program that enables you to measure the electricity use and your cost to operate your refrigerator, freezer and other appliances. This will also enable you to determine your savings from ENERGY STAR replacements.

Take advantage of the Efficiency Vermont meter loan program to determine the cost of operating your refrigerator. At the time of the walk-thru the refrigerator in the kitchen was ON and almost empty. See if it's possible to keep the refrigerator empty and OFF unless needed. Another option would be to purchase a smaller compact refrigerator for the few items that are needed.

- Fans

- Electric water heater when little or no hot water is needed

There are two (2) large hot water tanks in the boiler room that were identified for hand washing and dishwashing, respectively. This is a lot of hot water capacity to have available and if you can turn OFF one or both tanks when little hot water is needed it will save energy. Also, neither tank has an exterior insulation blanket, nor are any of the hot water supply pipes insulated. Tank insulation blankets and pipe insulation are inexpensive and easy to install.

- Other things to turn OFF

Consider turning off the heat to the radiators in the stairwells to the basement/dining room area of the annex.

#5 Add Insulation to

- Attic area above_____ to a depth of _____ inches of insulation; include insulation on the attic- side ("cold-side") of the attic access door/opening

The attic above the balcony area has no insulation and the area above the sanctuary has only six inches (6") of fiberglass insulation. If the church were being built new today you would install at least 12" to 15" of attic insulation. Since the sanctuary is only being heated for 4 hours per week the installation of additional insulation will not produce dramatic savings, but given the ease of access, additional insulation should be installed.
The attic area above the annex could not be inspected, but it appears that there is some fiberglass insulation in this attic. If the existing insulation is six inches or less, additional insulation should be installed. Since the annex is used and heated more throughout the week, the installation of additional insulation, if needed, will have a greater impact on heating energy use.

- Exterior walls: Adding insulation to existing walls is usually expensive. It should have lower priority than other lower cost opportunities, i.e. sealing air leaks and temperature setback.

- Basement walls: Adding insulation to basement walls is usually expensive. It should have less priority than other lower cost opportunities, i.e. sealing air leaks and temperature setback.

- Heating pipes in _____

The heating pipes in the boiler room and pipes to the radiators that are accessible should be insulated. Installing pipe insulation is relatively inexpensive and can be done with volunteers.

- Cold side of doors that separate heated from unheated spaces

Attic access panels should be insulated on the cold side.

- Domestic water heater and the hot water supply piping.
  NOTE: For gas/oil-fired water heaters, make sure that the insulation doesn't block the air intake at the bottom, nor the exhaust gas flue on top

- Other places to add insulation.

#6 Other Efficiency Opportunities

- Seal joints/connections in furnace ductwork to reduce air leakage: Up to 30% of the air heated by a furnace can be lost through leaks at joints/connections in the ductwork. Leaks in the cold air returns can also draw in colder air. Both types of leaks will cause the furnace to operate longer than necessary. Sealing leaks with mastic is relatively inexpensive and easy to do.

The ductwork associated with the new furnace under the sanctuary has been sealed, but much of the ductwork from the prior furnace which are still in use as supply and return ducts should be sealed. Sealing ducts with mastic is inexpensive and can be done by volunteers.

- Close/Seal floor vents between heated and unheated spaces

- Close window drapes/shades at night to reduce heat loss through windows

- Lay 6-8 mil plastic sheets over dirt basement and crawl space floors to reduce moisture entering the floor and spaces above.

- Purchase ENERGY STAR products, e.g. refrigerator, freezer, computer, furnace, windows, etc. Find ENERGY STAR products on www.energystar.gov

- Install exterior storm windows or interior plastic on windows with single pane glass

- Create vestibule entrance areas that will reduce air leakage when doors are open/closed frequently.

Installing a door at the end of the first floor hallway of the annex would create an entry vestibule that would reduce air leakage and heat loss.

- Cover skylights with insulated panels during the heating season

- Add heating system zone controls to improve your ability to reduce heating temperatures in unoccupied spaces

Since the pastor's office and the meeting room at the end of the annex are the most used spaces in the annex, you should consider installing a separate zone valve and thermostat to heat these rooms. This would avoid heating the classrooms when they are not occupied.

Another option could be to install a separate propane wall heater for the pastor's office and/or meeting room.

- Have oil-fired heating equipment serviced every year, including combustion efficiency testing

- Schedule meetings to minimize the heating of spaces, e.g. groups meeting at 5PM and 7PM should meet in the same room, if possible. See if groups that meet on different days could meet on the same day to avoid heating a space twice. Try to match the size of the meeting room/space to the size of the group so you don't heat a large space for a small group.

- Use task lighting, e.g. desk lamp, rather than room lighting

- Clear Areas Around Radiators and Forced Air Registers: Ensure that the areas above and in front of heating radiators and registers are clear to allow for movement of the heated air.

#7 Comments-Observations-Suggestions

- Home Performance with ENERGY STAR: For a comprehensive and quantitative assessment of the energy saving opportunities for residential and small commercial buildings contact a Home Performance with ENERGY STAR contractor (go to www.efficiencyvermont.com and follow links to Home Performance with ENERGY STAR). These contractors have been trained by Efficiency Vermont and certified by the Building Performance Institute (BPI) to be able to perform blower door tests, combustion efficiency tests, health and safety tests of appliances and they have also been trained in the proper installation of energy efficiency measures. There is usually a charge for the assessment, but Home Performance with ENERGY STAR contractors can be valuable resources.

Efficiency Vermont now offers incentives for small commercial customers who use Home Performance contractors to analyze building energy loss and to do air sealing and insulation. You should contact some Home Performance contractors to see if they can evaluate the annex portion of the church.

#8 Additional Resources

Vermont Interfaith Power and Light: 1-802-658-0902, www.vtipl.org

Efficiency Vermont: 1-888-921-5990, www.efficiencyvermont.com

ENERGY STAR: ww.energystar.gov

ENERGY STAR for Congregations:
http://www.energystar.gov/index.cfm?c=small_business.sb_congregations

Carbon Footprint of Faith Communities: www.coolcongregations.com

Renewable Energy Resource Center: www.rerc-vt.org

Renewable Energy Vermont: www.REVermont.org

Biomass: www.biomasscenter.org

Vermont Sustainable Jobs Fund: www.vsjf.org

Energy Efficiency Products:
link to SHOPipl on www.vtipl.org website, and
Energy Federation Incorporated, www.efi.org

Do-It-Yourself Advice: www.doityourself.com/energy

#9 Possible Funding Sources for Energy Efficiency

- Database of State Incentives for Renewables and Efficiency, which provides an overview of both state and federal incentives.

http://dsireusa.org/incentives/index.cfm?re=0&ee=1&spv=0&st=0&srp=1&state=VT

- The Vermont Department of Public Service: Clean Energy Development Fund

http://publicservice.vermont.gov/energy/ee_cleanenergyfund.html

- Efficiency Vermont, which provides incentives for electrical efficiency can sometimes offer incentives for projects that combine electrical and heating efficiency improvements. Efficiency Vermont may also be able to provide some technical assistance for your project or recommend resources that may be helpful.

www.EfficiencyVermont.com

- The Vermont Division for Historic Preservation has various grant programs that can be used by churches and other community organizations to make improvements in their facilities; depending on the project, you could explore the Historic Preservation, Cultural Facilities, and Human Services and Educational Facilities grant programs:
http://www.historicvermont.org/programs/building_communities_grants.htm

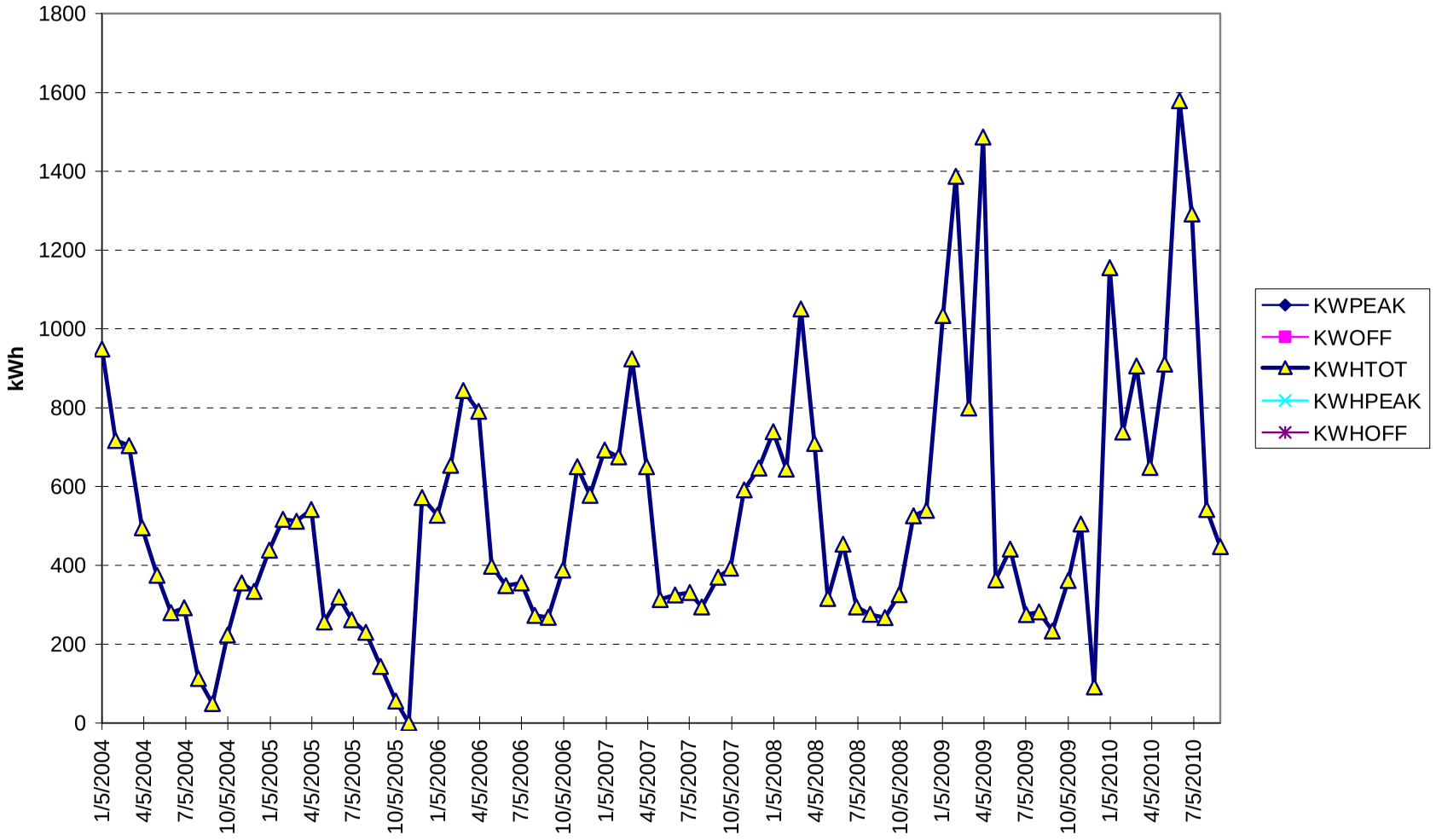
- Private Grants/Foundations: I can't identify specific foundations or grants, but the Community Foundation organization in Vermont can provide a list of foundations. I suggest that you "Google" Vermont Community Foundation.

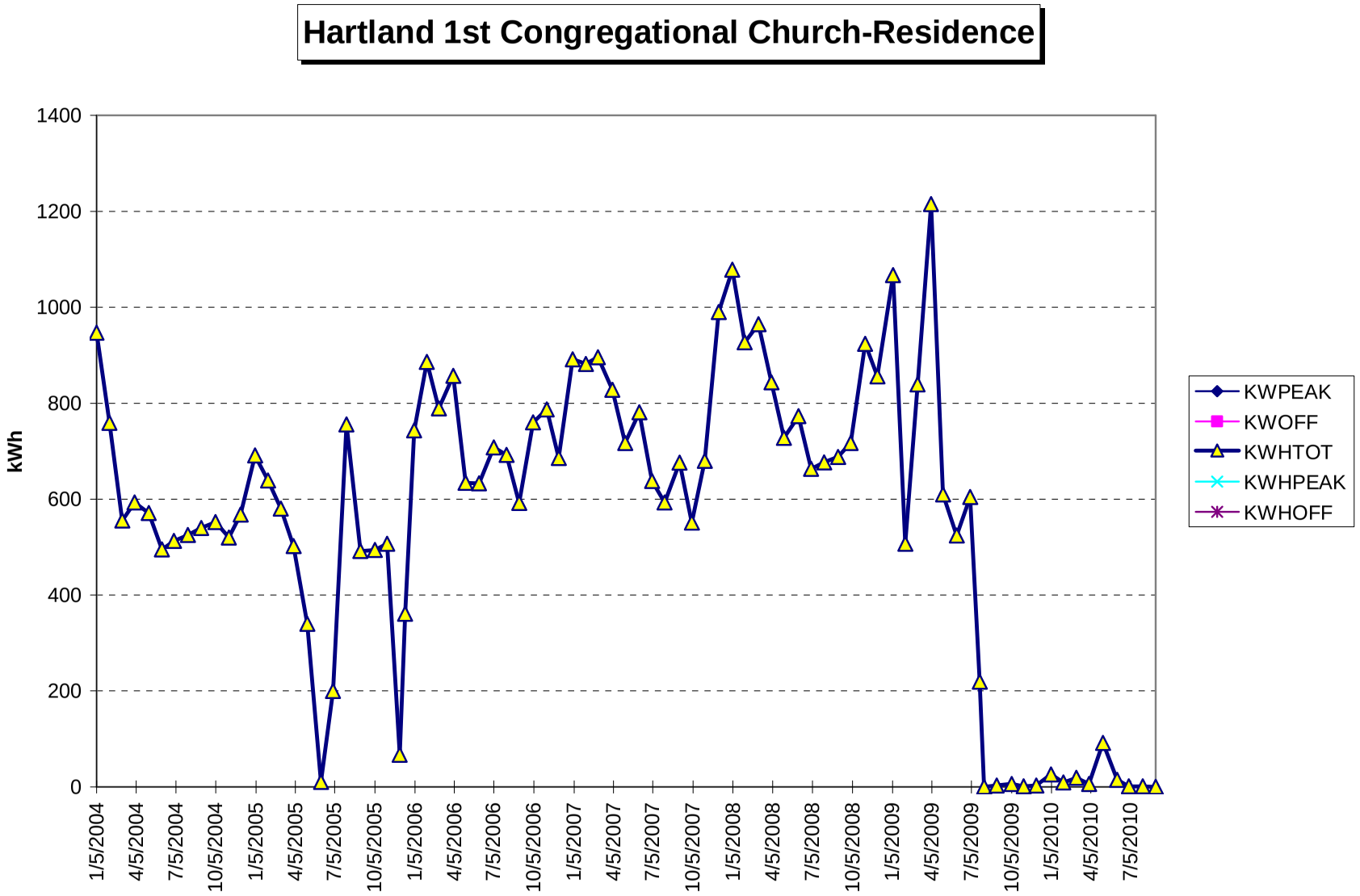
The following source is not currently applicable, but may be in the future:

- Vermont Agency of Natural Resources - Vermont Community Climate Change Grants

anr.VTClimateChangeGrant@state.vt.us
Contact: Don Einhorn 802-241-1093
The program had a fund of $$ for energy efficiency and all of the available $$ has been awarded. But, there may be additional $$ available in the future.

1st Congregational Church, Hartland, VT




Hartland 1st Congregational Church-Residence
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