

**PROPOSED ENERGY PLAN
FOR UNITY OF PRESCOTT
2015**

Prepared by the Green Committee, Unity of Prescott, 2-16-11

This plan is a statement of intent to follow an agreed upon energy strategy. Its objective is to provide an overview of existing conditions and options. Thus, it provides a basis for prioritizing various projects over time. This plan should be amended and updated as segments are completed and as circumstances change.

It does not bind the Board of Trustees to enter into any contract for goods or services, nor to expend any funds.

GOALS

1. Make a physical demonstration of our concern for the planet and endorsement of responsible use of resources.
2. Reduce consumption of fuels that contribute to air pollution and potential climate change.

PROCESSES

The above goals are to be achieved by:

1. Utilizing renewable energy sources to generate heat and electricity for church facilities to the maximum practical extent.
2. Retrofitting existing church buildings to reduce energy consumption, i.e., insulation, sealing, lighting.
3. Embracing new technologies and techniques.

PHOTOVOLTAIC ELEMENT

(Electricity)

Existing Conditions

There is a main church building and an education building, each with a separate electrical service and a separate APS account. APS will not permit a combined photovoltaic (PV) system for both buildings.

Existing wiring within the buildings provides for lighting, cooling, elevator, office machines and appliances.

The consumption of electricity for the main building for one year was about 23,700 kWh at a cost of \$4,700. By comparison, the annual cost of natural gas for the main building was about \$2,700.

Analysis

With greater expenditures for electricity than natural gas, there would be greater saving with a major PV system than a major solar natural gas hot water system primarily for space heating of the main building. Also, the installation of a major PV system would be mechanically simpler, and would provide benefits on a year-round basis.

Based on proposals from solar contractors, all or part of the usage from the electrical grid could be offset by the installation of solar PV systems in the main building.

Rapid advances in PV technology are expected in the future. Such progress could radically change the solar energy collection apparatus, increase efficiency, and reduce electricity costs.

SPACE HEATING ELEMENT

(NATURAL GAS)

Existing Conditions

The main church building and the education building each have separate natural gas systems. A relatively small boiler supplies hot water for radiators in the sanctuary and foyer. The boiler is not delivering all the heat it is capable of due to deficiencies in its piping system. A conventional hot water heater supplies hot water for the bathrooms and the kitchen.

Annual expenditures of \$2,700 for natural gas for the main building are significantly less than those for electricity (\$4,700).

Analysis

According to one of the contractor's findings, limitations of the physical plant do not offer a cost-effective way to offset the majority of the heating load for the sanctuary and foyer. However, the piping for the existing boiler could be upgraded at a cost of about \$4,000 to \$5,000. Such improvements would be expected to heat the spaces more rapidly.

For the offices, a solar space heating system could be a cost effective approach. The components are called SolarSheat panels and would cost about \$2,800. They do not use natural gas. Installation would be extra.

The existing conventional hot water heater is potentially adequate to meet everyday needs and needs for special events. It can be made to heat a large amount of hot water by turning the thermostat up in advance of the event. If solar re-piping is undertaken, heating domestic hot water with the boiler may be a cost effective step.

BUILDING EFFICIENCY ELEMENT

Existing Conditions

The church buildings were constructed at a time when there was little awareness of energy conservation techniques. Since purchase of the buildings by Unity, considerable work has been done to conserve energy by means of retrofitting measures.

Main Church Building and Attached Administrative Wing

An energy audit was performed in early winter 2010 by an outside firm (CORE Construction Services of AZ, Inc., Phoenix). They identified energy saving opportunities (un-ranked and without cost/benefit estimates) as follows:

Reduce heat loss in winter and heat gain in summer, thereby decreasing energy consumption while maintaining/enhancing comfort by:

1. Replacing all or selected steel frame/single pane glass and/or aluminum frame/clear glass to those which are thermally broken aluminum or vinyl frame tinted, low-e glass window assemblies.
2. Replacing all exterior door weather stripping and threshold gaskets, and re-caulking all joints to reduce air infiltration/leaks.
3. Replacing existing 40W light fixtures in the upstairs Administrative wing to new T-8 high efficiency lamps, electronic ballasts and tombstones.
(Note: Most other lights are not used frequently enough to justify replacing/upgrading.)

4. Insulation: Opportunities to increase insulation include:
 - a. Inspect church building attic space to assess current level of insulation above ceilings. If R-values are found to be below spec, add additional insulation.
 - b. Especially in the Administrative wing heavily occupied areas, provide interior wall furring with insulation to increase thermal mass and reduce cold air transfer through existing block walls.

- c. Repaint all exterior block walls with a ceramic based elastomeric paint that will decrease solar heat gain in summer conditions.

Addendum: Re-piping of existing boiler per **Plan of Action**, Item 3, below.

Education Building

An energy audit was performed during early/mid-2010 by an insulation firm (Advanced Insulation, Prescott). Numerous energy saving opportunities were cited (not ranked and with limited and/or questionable cost/benefit estimates), including but not limited to:

(Note: Where indicated, some of these were completed or partially completed.)

1. Replace most windows. The large window facing Arizona Street has subsequently been replaced.
2. Assess R-values of roof, wall and crawl space insulation. Additional ceiling insulation has subsequently been installed.
3. Leaking hot air ducts. Re-taping and other repairs to ducting have been accomplished.
4. Air leakage around doors, windows, exterior ducts, etc. was determined to be excessive.
5. Selected lighting fixtures: TBD
6. Heating and cooling system: TBD
7. Hot water system: TBD

PLAN OF ACTION

Due to funding limitations, a long-range staged plan is set forth as follows:

1. A Stage 1 Photovoltaic starter demonstration project would be undertaken first because of its potential for consciousness raising and incentivising financial contributions to the Solar Energy Fund. This project of about 2 kWh would cost about \$10,000 at current prices. Over time, the ultimate build-out of 20 kWh could be in the range of \$80,000 and would offset 100% of existing electric usage.

Owing to the potential for technological advances described above, a wait and see policy should be followed after installation of the Stage I PV starter system. At that time, better decisions as to how to proceed can be based on the then current state of the art.

2. The solar space heating system (SolarSheat panels) would be second in sequence because it would benefit our dedicated office staff and has a relatively modest cost.
3. The piping improvements to the existing boiler are to be third because they would speed up heating of the sanctuary and foyer on cold mornings, reduce natural gas consumption, and are moderate in cost. A possibility would be to attach a storage tank to the boiler for domestic hot water and incorporate a solar hot water component.
4. Subsequent additive stages to the PV system would be undertaken in the future based on available funding and technology advances.
5. Building efficiency upgrades based on the two Energy Audit Recommendations described above would be undertaken from time to time for specific projects. Financing for such projects is to come from individual donors for specific upgrade projects and/or from a newly established Building Efficiency Fund.

IMPLEMENTATION

The main challenge is in financing. Costs are falling in the industry, thereby reducing the ultimate system expenditure over time.

1. Donations from interested members of the congregation will be accumulated in a designated Solar Energy Fund and a designated Building Efficiency Fund.
2. After the church's financial position improves, utility cost savings from energy conservation measures implemented could be calculated and transferred to the respective funds.
3. Using this plan as a demonstration project, grants could be solicited from potential private and governmental agencies.
4. Media publicity for our project could bring "green enthusiasts" to Unity who could contribute to the project in terms of donations to the Solar Energy Fund, the Building Efficiency Fund, the General Fund, and in terms of work.
5. An agreement with a solar company to install their panels on the roof of the church. The church would buy the electricity produced at a below-market rate. An option for the church to purchase the panels would be desirable.

Addendum:

Option 1: Indirect water heater installation (Fired by boiler)

1. Removal & disposal of existing water heater.
2. Near boiler re-piping to accommodate domestic water functions.
3. Pump & controls for proper operation.
4. Installation of 80-gallon indirect water heater.
5. All domestic tie-ins.

Cost: \$4,065.00