



ENERGY CONSERVATION & STEWARDSHIP FOR THE CHURCH

Energy Conservation and Stewardship for the Church

We are called to be managers or stewards of what has been given to us. When it comes to energy we need to manage it wisely and creatively. By Colby May

“WHERE DO WE BEGIN?” This question is actually half the battle; simply asking this question states that the church understands their call, understands the threats, and is ready for a solution.

TABLE OF CONTENTS

2 ENERGY MANAGEMENT FOR CHURCHES?

Houses of Worship must change the way they think and operate regarding energy management—it’s essential to good stewardship.

5 WHAT CAN I EXPECT FROM MY CHURCH ENERGY AUDIT?

Energy Audits, Sustainability & Missions... My Story

8 YOU NEED TO MEASURE ENERGY USAGE.

Here’s 3 Ideas on How to Begin.

10 UNDERSTANDING PEAK DEMAND SAVES MONEY

13 BEHAVIOR BASED ENERGY CONSERVATION

16 ENERGY MANAGEMENT, CHURCH LIGHTING AND THE 23 SECOND RULE

Energy Management for Churches?

Houses of Worship must change the way they think and operate regarding energy management—it's essential to good stewardship.

ARE YOU AWARE that in many parts of the US, energy is the second-biggest budget item after salaries? And according to the Environmental Protection Agency we waste up to 30 percent of the energy we use. This is also true for churches and seminaries.

However the topmost concern is not “where do I start?” regarding energy management; rather the greatest concern is leadership understanding the importance of energy management.

The church is typically the last one to the table regarding energy management; the biggest reason being the lack of understanding and knowledge in this realm. If we do not understand energy management and do not see it as a threat we are much less inclined to remedy the situation.

UNDERSTANDING OUR CALL

Before we pursue energy conservation we must first understand our call. Part of our call as God's creation is to also be good stewards of that creation.

I believe Genesis 1:1 says it all: “God created the heavens and the Earth.” If we, and all that exists, are part of God's creation, are we to be wasteful with that which God created? Throughout the Bible, we are called to be good stewards.

In Greek, stewardship, or *oikonomia*, is the same word used to define management and administration. We are called to be managers or stewards of what has been given to us. When it comes to energy we need to manage it wisely and creatively. We will have enough energy for us today, but what about our children and our children's children? Let us be wise, responsible, and creative with the energy within our grasp today, so we can give future generations a better tomorrow.



UNDERSTANDING THE THREAT

As mentioned above, according to the EPA we waste up to 30 percent of energy we use. Think about this for a second. Many larger churches spend north of \$1,000,000 per year, and 30 percent would equate to \$300,000. This is a tremendous amount of resources, and sadly a very true scenario.

I have performed over 1,000 energy audits in my career and can testify to the findings. For example, during a hot day a church might turn their cooling to 68 degrees to condition their office, but what they might not realize is this practice is extremely expensive and deprecates the life of the air conditioning unit.

According to the Environmental Protection Agency (EPA) every degree changed can save up to 1.5 percent of the HVAC portion of your bill. They recommend keeping cooling set at 76-78 degrees. This simple act could save up to 15 percent on the HVAC portion of your bill.

RECOGNIZE OUR WEAKNESSES

The most common question we hear regarding energy management is “where do we begin?” This question is actually half the battle; simply asking this question states that the church understands their call, understands the threats, and is ready for a solution.

Energy Management is a big field and the opportunities to save energy are numerous. So in order to move forward with a plan we must first identify our weaknesses. Every athletic team first identifies and addresses areas of weakness before playing an opponent. By not doing so they play the game blindly. The same is said when pursuing sustainability. The best place to start in the arena of energy management/sustainability is to perform an energy audit.

ENERGY AUDIT

An energy audit will and should uncover every area of energy use and make proper recommendations in order to remedy any threats. These audits will look at Lighting, Heating, Ventilation, Air Conditioning, Building Envelope, Plug Load, Utility Bills, Behavior and more, then address each opportunity with a respective plan.

There are a number of consultants available to perform energy audits, should your facility be interested. Be careful in your selection of an auditor and be sure to find a neutral third party.

"Let us be wise, responsible, and creative with the energy within our grasp today, so we can give future generations a better tomorrow."

MY STORY

As you read through my twelve part series on Energy Management I wanted to briefly share my story and the reason I'm in this vocation. In 2003 I began my career in the energy management field and enjoyed it, but was never fulfilled. I loved the church and wanted to serve the church in a greater capacity not just locally but globally.

After 10 years in the field, I decided to attend seminary at Gordon Conwell in the Boston area. The idea was to go deeper in my study of ethics, society and justice. I spent part of that time in Goma, Congo with an organization called World Relief during the Kivu Conflict. During that time I studied the local church's response to conflict and injustice, and believe me there was a lot of it.

I became passionate about this type of strategic empowerment and wanted to dedicate myself to the cause, but the question remains how. How can I leverage my 12 years of experience in Energy Management to empower strategic missions? Well the answer was simple and it starts with energy audits.

We currently focus on renewable energy and energy management as a tool to empower (job creation, energy independence and more). However local energy audits, if done and followed up on properly, can potentially lead a church, seminary or college to save 20 percent. If a church spends \$200,000 annually on utilities, yet saves 20 percent, they are freeing up \$40,000--that can be poured back into missions or community.

There are a number of details I am glossing over, but the concept is straightforward. We are seeing churches change the way they think and operate regarding energy management and it is encouraging to see.

What Can I Expect from My Church Energy Audit?

Energy Audits, Sustainability & Missions... My Story

IN LAST MONTH'S ARTICLE, "Energy Management for Churches" we address our call regarding energy management. As mentioned energy, and related expenses, is typically the second biggest budget item on most utility budgets, and according to the Environmental Protection Agency 30 percent of the way we use energy is wasted. The idea around the article is promoting stewardship and saving energy. But where do we begin, as mentioned the best place to start is with an energy audit or energy assessment from a neutral third party.

MY STORY

I do want to address the importance of an energy audit, thus empowering church leaders to dig deeper and engage in this arena. But before we get started I want to briefly share my story and the reason I am in this vocation. In 2003 I began my career in the energy management field and enjoyed it, but was never fulfilled. I loved the church and wanted to serve the church in a greater capacity not just locally but globally. After 10 years in the field, I decided to attend seminary at Gordon-Conwell in the Boston area. The idea was to go deeper in my study of ethics, society and justice. I spent part of that time in Goma, Congo with an organization called World Relief during the Kivu Conflict. During that time I studied the local church's response to conflict and injustice, and believe me there was a lot of it. I became passionate about this type of strategic empowerment and wanted to dedicate myself to the cause, but the question remains how. How can I leverage my 12 years experience in Energy Management to empower strategic missions? Well the answer was simple and it starts with energy audits. We currently focus on renewable energy and energy management as a tool to empower (job creation, energy



independence and more). However locally energy audits, if done and followed up on properly, can potentially lead a church, seminary or college to save 20 percent. If a church spends \$200,000 annually on utilities, yet saves 20 percent, they are freeing up \$40,000 that can then be poured back into missions or community. There are a number of details I am glossing over, but the concept is straightforward. We are seeing churches change the way they think and operate regarding energy management and it is encouraging to see.

ENERGY AUDITS DONE RIGHT

Like anything when pursuing energy management we must be careful and think strategically. Our first recommendation when having an audit done on your facility is to choose the right auditor. There are a number of organizations that promote free audits, but many times the companies are trying to sell you a service (HVAC system, lighting upgrades, Controls or more) or the organization is not as qualified to perform the audit. Be sure to choose an organization that is seen as a neutral third party, and has vast array of experience (check references). In my opinion it is better to pay for a professional detailed audit then to have a free one done. These audits can be broken down into three different types, and it is important to know the differences:

- › **ASHRAE LEVEL 1** - These are not typically a detailed inventory of equipment and practices, but rather a broad overview.
- › **ASHRAE LEVEL 2** - This is a detailed analysis, inventory of all major equipment, utilities, operations and behavior. These audits should pay for themselves under 3-6 months from their recommendations.
- › **ASHRAE LEVEL 3** - Finely detailed audit covering all areas. Can cost anywhere from \$.10-.30 per square foot.

My recommendation for a first time audit is a level 2, which is detailed enough, yet not too expensive. The audit should identify energy use and savings opportunities in the following areas:

- 1. HEATING** – Identify the existing equipment, recommended replacement, payback and more. It should also make recommendations centered on improving operations.
- 2. COOLING** – Identify equipment, replacement, payback and improving operation

"We are seeing churches change the way they think and operate regarding energy management and it is encouraging to see."

3. LIGHTING – Focus on de-lamping, daylight harvesting, renovation, payback and more.

4. BUILDING ENVELOPE – Insulation, weather stripping

5. UTILITY BILLS – Peak Demand, Billing errors, rate schedule analysis and more.

6. PLUG LOAD

7. INCENTIVES RESEARCH

8. CONTROLS/THERMOSTATS

9. WATER ASSESSMENT

10. BEHAVIOR – The biggest area to save is found in the way we manage our equipment.

Energy Management is a very broad area, but the need to manage energy is only going to increase. As a church body we should not only follow the curve, but we should take the lead.

You Need to Measure Energy Usage.

Here's 3 Ideas on How to Begin.

THERE IS A FRIEND OF MINE who takes his family camping numerous times a year. They do it so much that they invested in a travel trailer. He was telling me this one specific campsite did not have a water hook up, and the only way to get water for his trailer was a faucet a half mile away. For some reason, of which I do not fully understand, he could not take his truck to pick up the water. As a result he walked two-10 gallon jugs (on wheels) down this hill in order to fill up the water. The bad news is he had to walk the “full” 10-gallon jugs up hill to the trailer.

I forgot to mention that they went camping in Texas in July. Suffice to say there was allot of sweat, numerous breaks, and an exhausted individual at the end of the journey. After he got to the trailer he lifted the heavy containers and emptied them into the trailer, which took some time and effort.

When all was said and done he walked into the air-conditioned trailer and found his wife and his daughter brushing their teeth, however they had all the water faucets (not low flow) on full throttle wasting the water that he had just mightily carried up the hill. In a panic his first response was “Stop! Turn that off--that's my water!” It worked... They turned off the water. They had no idea what he went through to provide water for the family. They had no idea how much water was in the tank, they assumed there was an unlimited supply. It was not until he shared the story that they understood.

When we get our utility bills most of us do not pay much attention. We just pay it and go about our day. We do not change the way we use energy and it shows at the end of every month.

However, studies show that behavior changes once we have been empowered. For example, when we drive our cars we read our gas gauge. When we are on empty we fill up. Our actions are dependent on that gas gauge. In college my gas gauge did not work, and of course I had



no money to fix it. I ran out of gas at least ten times, because I had no idea what was in the tank.

The same can be said about measuring and understanding our energy use (Water, Gas, Oil, Electricity and Propane). Studies show that those who measure and verify their utility costs use 15 percent less energy than those who do not measure. There are a number of ways we can measure and monitor our energy use:

INVEST IN SMART METERS I am a big believer in smart meters. They have the ability to save energy by empowering the end user. Smart meters give the end user a live read (actually 15 minute delay) and allow the user to change the way they operate and behave based on energy peaks. I can write a separate article on this, but point being they work. There was a school district that invested over \$1 million to equip their schools with smart meters, the project paid for itself in under a year.

BENCHMARK ENERGY USE. Put simply, bench marking is the process of comparing your energy performance to something similar. "Something similar" might be internal, like performance at the same time last year. Or it might be external, like performance compared to similar facilities elsewhere. Any easy way (funded through tax money) to benchmark your utility use is with a program called

PORTFOLIO MANAGER (PM) PM is an online tool you can use to measure and track energy and water consumption, as well as greenhouse gas emissions. Look across the street. Many utility companies now send historic energy use for the past 12 months, and grade your use in comparison to neighbors. These simple steps invite healthy competition and promote efficiency.

Understanding and measuring energy use empowers the end user to make smart decisions. There are numerous programs, technologies and services available today that can help. We encourage churches, seminaries, homeowners and more to stay proactive and know where your energy use is going. Turn the temperature down or up by a few degrees (can save 1.5 percent on the HVAC portion of your utilities for every degree changed), turn HVAC off or in set back mode when you leave, turn off lights, invest in plug load adapter and if you ever buy a travel trailer remember to keep the water off.

"Studies show that those who measure and verify their utility costs use 15 percent less energy than those who do not measure."

Understanding Peak Demand Saves Money

IS IT POSSIBLE TO USE MORE ENERGY, while at the same time lowering your overall energy cost? While I need to flesh this out the answer is yes. Of course our goals should be managing our energy to the best of our ability, but there are other aspects of our energy use that we must understand.

ELECTRIC USE BREAKDOWN

Our electric bill is measured in a number of ways. One is kWh or Kilowatts per hour. The kWh you see on your electric bills are the total number of kilowatts used in a billing cycle (typically 30 days). Rates per kWh vary, but range from \$.06-\$.15 per kWh. kWh is directly tied to our energy use. If we use more kWh and thus cost increase, if we use less our kWh and thus cost decrease. However there is another area of utility bills we MUST understand, as many churches (not all) are being charged. This area is called peak demand.

UNDERSTANDING PEAK DEMAND

Peak Demand or kW is energy measured over a 15-minute period of time. The utility company will then charge you for the HIGHEST 15-minute period for a given month.

For example if your average kW is around 150 kW, then during a very busy and very hot time of the day you decide to turn on all HVAC, Lighting, and plug load your kW spikes to 250. You will not be charged the 150 kW in reference to peak demand. The utility company will charge you the 250 kW x the demand rate \$10 (fluctuated per region), this means you facility will pay \$2,500 opposed to the \$1,500.

Not only this, but also most areas charge an annual Peak Demand (can also be called Ratchet Demand), where the utility will charge the client for the highest kW during a given year.

For example: Church-A averages 250 kW per month, but during a hot Friday in July the church schedules an outreach event. The kW skyrockets to 450 kW. The church will be charged the 450 kW for the next 11- months and not the 250 kW. This not only impacts the month, but impacts the entire year. $450 \times \$10 \times 12 \text{ months} =$



\$54,000 compared to $250 \times \$10 \times 12 \text{ Months} = \$30,000$. This one event cost the church \$24,000.

There is a lot of information I am glossing over, rates of peak demand differ (\$4-\$18/kW), the way peak demand is charged differ (some charge 80 percent of peak use, some only charge for 6 months), however this is a very real charge. This is also a very understandable charge, as utility companies must prepare for electric spikes during peak periods, this cost is of course passed on to the customer. Peak demand is only charged during peak time.

Peak periods on average are only during the months of **June-September, Monday through Friday**, from the hours **2pm to 6pm**, however this can differ per region, there is also winter peak periods in some regions.

OUR BEHAVIOR CAN HAVE A STRONG IMPACT PEAK DEMAND

The way we use energy during peak period can make a strong impact on our cost. Knowledge is power, for example if we know peak demand is from the hours of 2pm-5pm, Monday through Friday, June through September, then we can adjust the schedules of our church to minimize use during peak times. The good news about churches is that most large meetings are on Sundays, however this does not mean we do not use the church during peak hours. Perhaps your church decides to adopt a rule that disallows large meetings during peak hours. Or perhaps during peak months you adopt a summer schedule for staff (7am-2pm -Monday-Friday). Or perhaps you decide to only occupy one zone of the church, while keeping other HVAC zones in minimal or set back periods. There are a number of ways to adapt our use during peak times, and I encourage the churches to reach out to their energy consultant or find a consultant that can assist in this area. **One specific organization we met with saved over \$100k by simply changing the way they operate during peak periods.** We encourage churches to investigate if being charged peak demand, the hours of peak demand, the rates and more. Keep in mind this is for electricity only and not for gas. Also keep in mind that electricity is typically 3 times the cost of gas. For areas that are charged winter peak demand, electric heat make a big impact.

Other areas that impact peak demand:

- › **LIGHTING** – minimize light use, turn off when gone longer than 23 seconds

"The way we use energy during peak period can make a strong impact on our cost. Knowledge is power."

- › **PLUG LOAD** – Unplug items in the wall or invest in plug load adapters.
- › **BUILDING ENVELOPE** – Keep doors and windows well insulated and closed.
- › **HVAC** – Makes up (on average) 50 percent of a building electrical load. Be smart during peak periods. Set back HVAC to higher temp, only turn on zones that are occupied, minimize occupancy hours, turn off when not in use, and more.

Behavior Based Energy Conservation

QUESTION, what is the biggest factor on a building's energy use? Is it the HVAC, lighting, building envelope, or behavior? Of course the title gave it away, but if you answered behavior you are correct.

The following practices that should be considered when operating your HVAC:

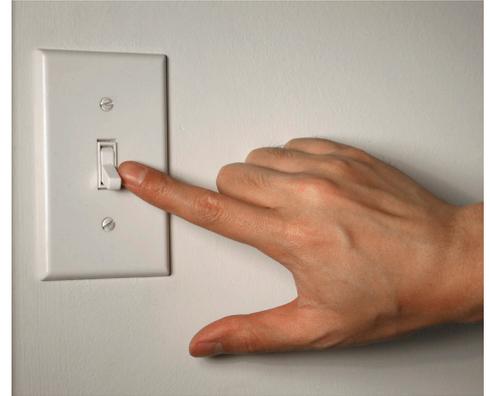
ZONING. As mentioned in the above examples zoning offers a great way to maximize energy-efficiency. The ideal position is to only condition the zones that are occupied, thus the importance of paralleling the church calendar with the HVAC controls.

HOURS OF OPERATION. This too is a very important factor in behavior. If your church or zone is only occupied for two hours a day, the area should only be conditioned during those occupied hours. Of course there is some contingency built in because it takes a certain period of time for areas to reach a desired temperature set point.

TEMPERATURE SET POINT. According to the EPA a facility can save 1.5 percent on the HVAC portion of their utility bill for every degree they change. Example if your average church temperature setpoint is 72° and you adjust to 74°, then the church will see A 3 percent savings on the HVAC portion of their utility bills.

SETBACK MODE. The most efficient mode for any HVAC system is off. However certain systems or building envelope will not allow a system to be turned off. For example in colder environments with steam or forced hot water, flow rates are important so pipes do not freeze or burst. In other areas building envelopes are not strong enough to maintain desired temperatures. In these cases we recommend an aggressive set back temperature that match the corresponding seasons.

OUTSIDE AIR. Per code there must be a certain amount of an outside air that comes into the building during



occupied hours. Most of the facilities allow for this practice, however most facilities do not adjust for unoccupied hours. If doable, outside air damper's should be closed during non-occupied hours. Conditioning outside air is a very expensive habit. However energy can be saved if the outside air damper's are closed during unoccupied hours.

I have mentioned this in past articles, but it is worth mentioning again, "According to the environmental protection agency, 30 percent of the energy we use today is used inefficiently". We might have the most energy efficient chiller or boiler, have efficient LED lighting, have triple pane windows, and still be using 30 percent more energy than needed. There is a common misconception that when installing new equipment, that efficiency takes care of itself. This is not the case. Sure a 17 SEER rooftop unit is much more efficient than a 30-year-old unit. However, if the owner of the 30 year old unit controls the use whereby the owner of the new unit does not control use, the older unit will use less energy. This makes sense.

The goal of any energy management program should be to hug occupancy. Basically I mean that lighting, heating, cooling, plug load, and others should be running in the most efficient manner possible only when the building is occupied. When the building is unoccupied the facility should be in it's setback or off position.

I would like to focus this article on the importance of scheduling, zoning, and set back temperatures related to heating ventilation and air-conditioning.

It is extremely important to parallel HVAC use to church calendars. Let me give you an example, say you walk in to church-A and the church has 10 different HVAC zones. Meaning the church has the ability to independently control separate zones. Zone one operates at a different temperature set point than zone 10. However instead of maximizing these different zones, the church turns on all 10 zones for 12 hours at 72 degrees regardless of the occupied zone. This is a very expensive habit. However, say we walk into church-B. We might find a church that is maximizing their system. For example the church is occupied in zones one, two and three on Monday, Wednesday and Friday. Opposed to turning on all 10 zones, the church only conditions the occupied zones for the occupied time (4 hours) while keeping the other seven zones off or in set back mode. We see this type of practice every day during our energy audits, and as mentioned it is an

"I believe a church facility manager is one of the most important positions in a medium to large size church. The facility manager is able to oversee practices such as zoning, which more than pays for itself."

expensive behavior-related practice. Church-A, given the example, might spend \$10,000 a month on the HVAC portion of their utility bills. On the other hand church-B, might spend \$5000 on the HVAC portion of their utility bill. There are a number of standards and practices that I am glossing over, but the concept is very real and very doable. This is why I believe a church facility manager is one of the most important positions in a medium to large size church. The facility manager is able to oversee practices such as zoning, which more than pays for itself.

If you read this far in the article it means you have not fallen asleep. Kudos! If you have any related questions we highly recommend you consult with your energy management firm, or feel free to reach me at **Colby@consultlit.com**.

Energy Management, Church Lighting and the 23 SECOND RULE

There was a study done by the Myth Busters a number of years ago that studied the myth about turning off lights.

The myth focused on the surge of electricity that takes place when we turn lights on and off. To summarize many people believe that the surge of energy is so great that it is not worth turning off lights when the room is unoccupied.

The myth was busted. Yes, there is a small surge of energy, but the payback is 23 seconds. If you are gone from your room longer than 23 seconds it pays to turn off your lights. According to Watt Watchers the average classroom can save \$50-\$75 per year by turning off lights on an average of two hours or more per day.

I wanted to focus this article on the importance of making smart decisions with lighting. I am not a lighting firm, point being I am not trying to sell you a service or product in this article. My hope is to give you advice from a neutral third party.

As mentioned in a previous article my goal is to empower churches, colleges and seminaries in the area of energy management with the hope this would free up finances to empower missions. Lighting is a very big part of our daily decisions, yet we do not give it much thought. If we were to break down the average building electrical use, lighting would make up about 15-20 percent. I would increase that percentage for churches. It is a big part of our worship services, depending on the church of course. However there are a number of ways we can impact our lighting use through little or no cost. Before I break down practical examples I wanted to share a quick example. I was performing an energy audit of a 500,000 square foot facility that had an annual electric cost of \$1.2 million. This facility, a museum, is open to the public only about 6 to 8 hours a day, however their lights were on for 18 hours a day. Lighting in a museum is vital to artwork, suffice to say their lighting load was significant, and made up about 25 percent of their electrical use.

If all the facility did were modify lighting hours (mean-



ing no investment) then they would save over fifty percent on their total electric costs. This equates to over \$150,000 by simply changing behavior. This is an extreme example and there are a number of factors I left out of this equation, but the fact remains--managing our lighting load makes a very big difference.

LIGHTING PRACTICES

TURN THEM OFF. If you are gone from anywhere longer than 23 seconds you're your lights off. It makes a difference.

DE-LAMP. According to the IESNA, certain areas like hallways, classrooms, worships areas, common areas and more require a certain footcandle (a way to measure light output), however the average facility keeps these facilities over lit. We highly recommend de-lamping areas that are over lit. For example a church office might have 4 4-lamp linear fluorescents (T8) fixtures that measure over 100 footcandles. According to the IESNA offices should range from 30-50. In such a case the church could de-lamp each fixture from 2-4 lamps, or turn off two of the fixtures.

DAYLIGHT. I performed an audit at a large Houston church last week. The hallway had a large window covering the length of the corridor that allowed outside light (ambient light) to brighten the area. The lights in the hallway were also on, but did not provide an increase in footcandles due to the ambient light. We would either recommend adding a photocell to these lights or disengage during daylight hours.

SWITCHING OR DIMMING. In many offices and classrooms, switching allows a user to use all or half the lights. In these cases we recommend using half-lights when possible.

LAMPS. When convenient use a desk lamp (preferably with LED bulb) opposed to turning on the office lights.

LED. I will write a separate article on LED lamps, but I am a big proponent. LED bulbs use minimal wattage (8 watts opposed to 60 watts) and last 5-10x the life of incandescent.